

WARNING

DEATH OR CONTACT OR SEVERE INJURY

may result if personnel fail to observe safety precaution.

HIGH VOLTAGE

When operating this machine
avoid high voltage lines.

FIRE HAZARD

When operating a truck crane, provide metal to metal contact
between fuel filler nozzle and gasoline tank.
Do not prevent sparks which might ignite fuel and result in
injury or death to personnel and destruction of equipment.

DANGEROUS STEAM AND AIR PRESSURE

Turn radiator cap slowly to allow pressure to
escape before removing cap.

Inflate tires from the side opposite the ring. If
the ring is improperly installed, air pressure may cause it to fly off
the wheel and serious injury to personnel may result.

CHANGE }
No. 1 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, 8 January 1982

**Organizational Maintenance Manual
CRANE-SHOVEL, TRUCK MOUNTED; 3/4 CUBIC YARD;
20 TON; WITH CLAMSHELL, DRAGLINE, AND BACKHOE
ATTACHMENTS; G.E.D. (HARNISCHFEGER CORP MODEL M320T2)
NSN 3810-00-151-4431**

TM 5-3810-294-20, 5 April 1974, is changed as follows:

Page iv, following number 2-72 add the following:

2-72.1 Air cleaner service 2-84.

Page v, following number 2-105 add the following:

2-105.1 Adjusting front and rear drum brakes. 2-110.

2-105.2 Location of chains and chain shafts . . 2-110.

Page 1-1.

Paragraph 1-4 line 1. Change "TM 7480-90-1" to "TM 740-90-1".

Paragraph 1-5 is superseded as follows.

1-5. Reporting Errors and Recommending Improvements

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA 2028 (Recommended Changes to Publications and Blank Forms) direct to: Commander, US Army Tank-

Automotive Command, ATTN: DRSTA-MBP, Warren, MI 48090. A reply will be furnished to you.

Page 2-3, paragraph 2-4e(3). Following subparagraph (3) add.

CAUTION

When reeving a three or more part line, position the cable outside the boom point cable guards. This will prevent the cable dragging on the inside rear of the guards.

Page 2-25, paragraph 2-10a. Warning is superseded as follows.

WARNING

Do not transport crane with the clamshell bucket, the dragline attachments, or the piledriver front end installed.

Page 2-26, Section V is superseded as follows.

Section V. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

2-17. General

Preventive maintenance is detecting/correcting problems before they happen, or fixing little problems before they become big problems. Table 2-1 contains a list of preventive maintenance checks and services to be performed by organizational maintenance personnel. Attention to these checks and services will increase the useful life of the crane but every possible problem cannot be covered in the PMCS. You need to be alert for anything that might cause a problem. If anything does look wrong, and you can't fix it, write it on a DA Form 2494 and report it to your supervisor. Be sure to record any corrective action.

2-18. Organizational Preventive Maintenance Checks and Services

a. Perform the checks and services at the intervals shown in table 2-1.

- (1) Do the (Q) checks and services once each three months.
- (2) Do the (S) checks and services twice a year, or each six months.
- (3) Do the (A) checks and services once each year.
- (4) Do the (B) checks and services once each two years.
- (5) Do the (H) checks and services at the hour interval listed.
- (6) Do the (MI) checks and services when the mileage of the vehicle reaches the amount listed.

b. If the crane doesn't work properly and you can't see what is wrong, refer to section VI for troubleshooting instructions.

c. Make cleanup a part of your preventive maintenance. Dirt, grease, oil, and debris may cover up a serious problem. Use drycleaning solvent (SD-2) to clean metal surfaces. Wipe off excess grease and spilled oil. Use soap and water when you clean rubber or plastic material.

d. Watch for and correct anything that might cause a problem with the crane. Some things you should

watch for are:

- (1) Bolts, nuts, and screws that are loose, missing, bent, or broken.
- (2) Welds that are bad or broken.
- (3) Electric wires and connectors that are bare, broken, or loose.
- (4) Hoses and fluid lines that leak, or show signs of damage or wear.

e. You should know how fluid leaks affect the status of your equipment. Learn and be familiar with the following definitions of the types/classes of leakage. Remember—when in doubt, notify your supervisor!

Leakage definitions for PMCS are:

- CLASS I Seepage of fluid (indicated by wetness or discoloration) not great enough to form drops.
- CLASS II Leakage of fluid great enough to form drops but not enough to cause drops to drip from the item being checked/inspected.
- CLASS III Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

CAUTION

Equipment operation is allowable with minor leakage (Class I or II). Of course, consideration must be given to the fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.

When operating with Class I or II leaks, continue to check fluid levels as required by the PMCS.

Class III leaks should be corrected before releasing equipment for operation.

Page 2-26. Table 2-1 is superseded as follows.

Table 2.1. Organizational Preventive Maintenance Checks and Services (CRANE)

Item No.	Interval						ITEM TO BE INSPECTED Procedure
	Q	S	A	B	H	MI	
							<p>NOTE</p> <p>PERFORM OPERATOR/CREW PMCS PRIOR TO OR IN CONJUNCTION WITH ORGANIZATIONAL PMCS.</p>
1	•						<p>FUEL TANK, LINES, AND FITTINGS</p> <p>Inspect lines and fittings for leaks. Tighten loose fittings. Replace damaged lines or fittings (para 2-79).</p>
2	•						<p>RADIATOR</p> <p>Tighten mounting clamps and connections if necessary, making sure no leaks are apparent. The correct cap pressure rating is 4 psi. Replace cracked or damaged hose. Replace a leaking or faulty radiator (para 2-74).</p>
3	•						<p>V-BELTS</p> <p>Inspect for worn, frayed, or cracked belts. Adjust as required (fig. 2-85).</p>
4	•						<p>BATTERIES</p> <p>Check electrolyte level and specific gravity (1.285-1.300) using hydrometer. Check tightness of connections. Fill to 3/8-inch above the plates. In freezing weather, run engine for 30 minutes after adding water. Clean vent hole in filler caps before installing (para 2-53).</p>
5	•						<p>HOOK ROLLERS</p> <p>Inspect hook rollers for wear and proper adjustment. Maximum allowable clearance between rollers and lower side of roller path is 1/16-inch. Replace severely worn rollers (para 2-111).</p>
6	•						<p>GANTRY</p> <p>Inspect for cracks, worn sheaves, and improper lubrication (para 2-65).</p>
7	•						<p>BOOM AND/OR JIB</p> <p>Inspect visually for damage, including cracks, breaks, and general condition. Repair or replace damaged boom or jib sections (para 2-37).</p>
8	•						<p>REAR DRUM DRIVE CHAIN, REVERSING CHAIN, SHOVEL CROWD CHAIN, AND HORIZONTAL SWING SHAFT CHAIN</p> <p>Inspect for wear. Replace chain if worn excessively (para 2-110).</p>
9	•						<p>LIGHTS</p> <p>Inspect lights for loose cables, mountings, cracked lens, and proper operation. Repair or replace defective lamps or bulbs (para 2-51).</p>
10	•						<p>ENGINE CLUTCH</p> <p>Inspect and adjust if necessary (para 2-101).</p>
11	•						<p>FRONT DRUM CLUTCH</p> <p>Check operation; adjust if necessary. Check lining thickness; if band is worn to within 1/16-inch of rivet heads at point of most wear, install new band (para 2-106).</p>
12	•						<p>FRONT DRUM BRAKE</p> <p>Check operation; adjust if necessary. If band is worn to within 1/16-inch of rivet heads at point of most wear, install new band (para 2-106).</p>
13	•						<p>REAR DRUM CLUTCH</p> <p>Check operation; adjust if necessary. If band is worn to within 1/16-inch of rivet heads at point of most wear, install new band (para 2-105).</p>
14	•						<p>REAR DRUM BRAKE</p> <p>Check operation; adjust if necessary. If band is worn to within 1/16-inch of rivet heads at point of most wear, install new band (para 2-105).</p>
15	•						<p>BOOM HOIST CLUTCH</p> <p>Check operation; adjust if necessary. If band is worn to within 1/16-inch of rivet heads at point of most wear, install new band (para 2-108).</p>
16	•						<p>BOOM HOIST BRAKE</p> <p>Check operation; adjust as necessary (para 2-112).</p>

Page 2-84, paragraph 2-78.

Subparagraph *b* is superseded as follows.

b. Removal. Refer to figure 2-72 and remove the air cleaner.

Subparagraphs *c* and *d* are added as follows.

c. Service. Refer to figure 2-72.1 and service the air cleaner.

d. Replacement. Refer to figure 2-72 and replace the air cleaner.

Figure 2-72.1 is added as follows.

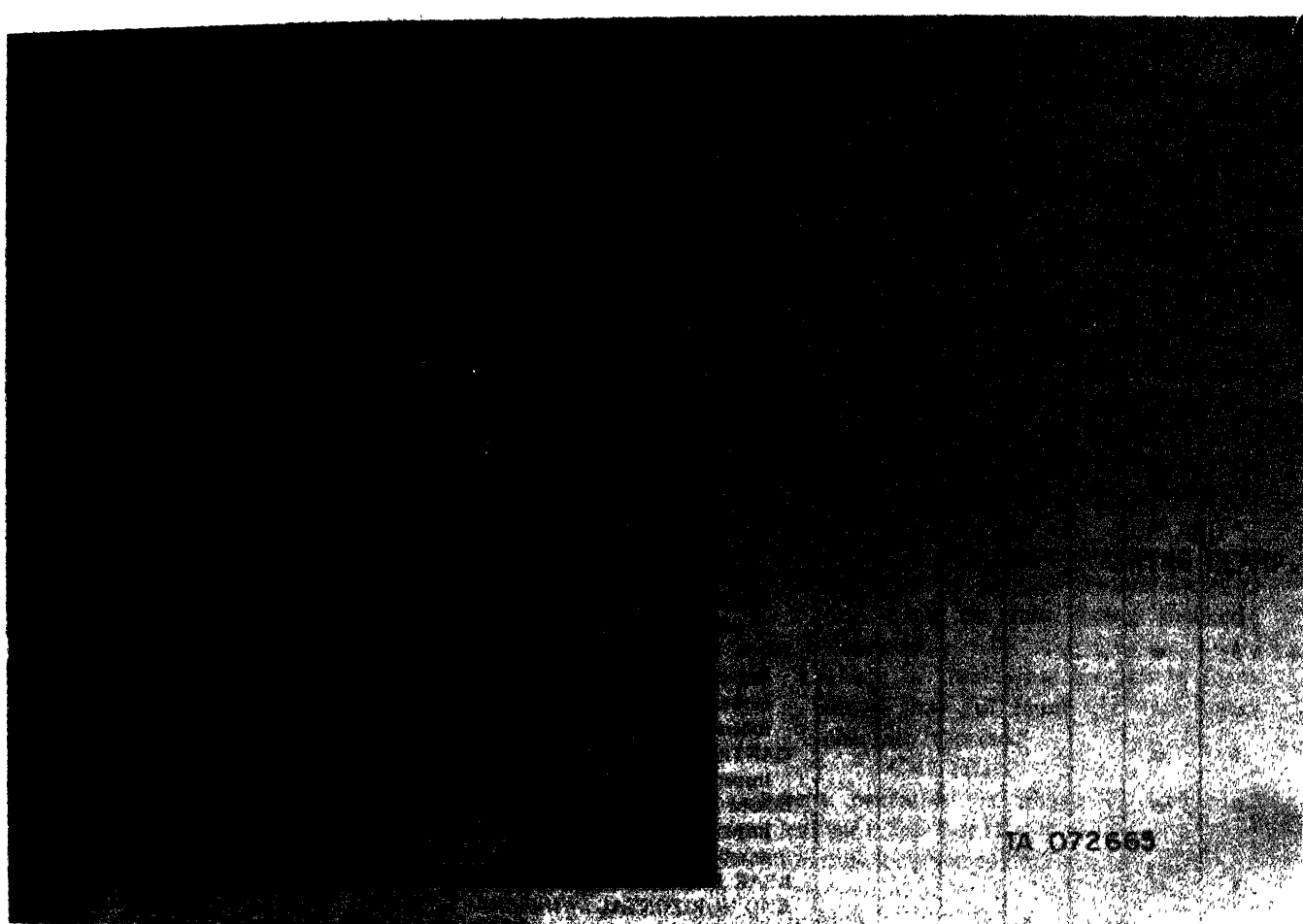


Figure 2-72.1. Air cleaner service

Page 2-110

Paragraph 2-104b(1) change "figure 2-105" to "figure 2-105.2"

Paragraph 2-105b third sentence is changed to read as follows

Adjust the clutch to the desired position by removing the primary wire from the distributor, setting the ignition switch to ON, and then tapping the engine start button.

Following paragraph 2-106 add the following:

2-106.1. Front and Rear Drum Brake Service and Adjustment

a. Service. Keep the mechanical components of the rear drum brake clean and dry. Do not allow hydraulic fluid to come into contact with brake linings.

b. Adjust. The adjustment of both of these brakes is identical and is done with hydraulic pressure off. No pressure should be placed on the operating foot pedal. Refer to figure 2-105.1 and adjust the front or rear drum brake.

Figures 2-105.1 and 2-105.2 are added as follows.

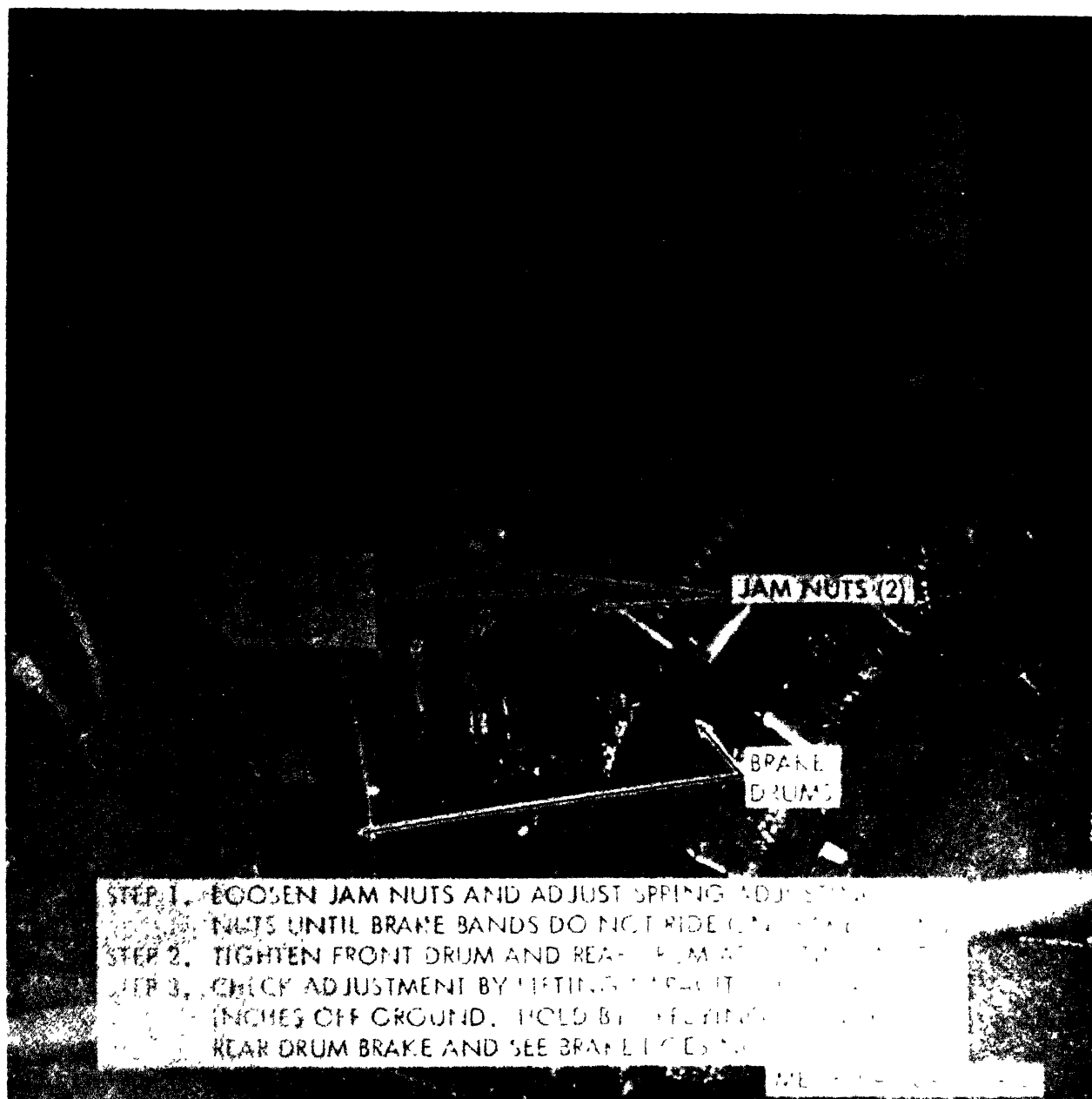
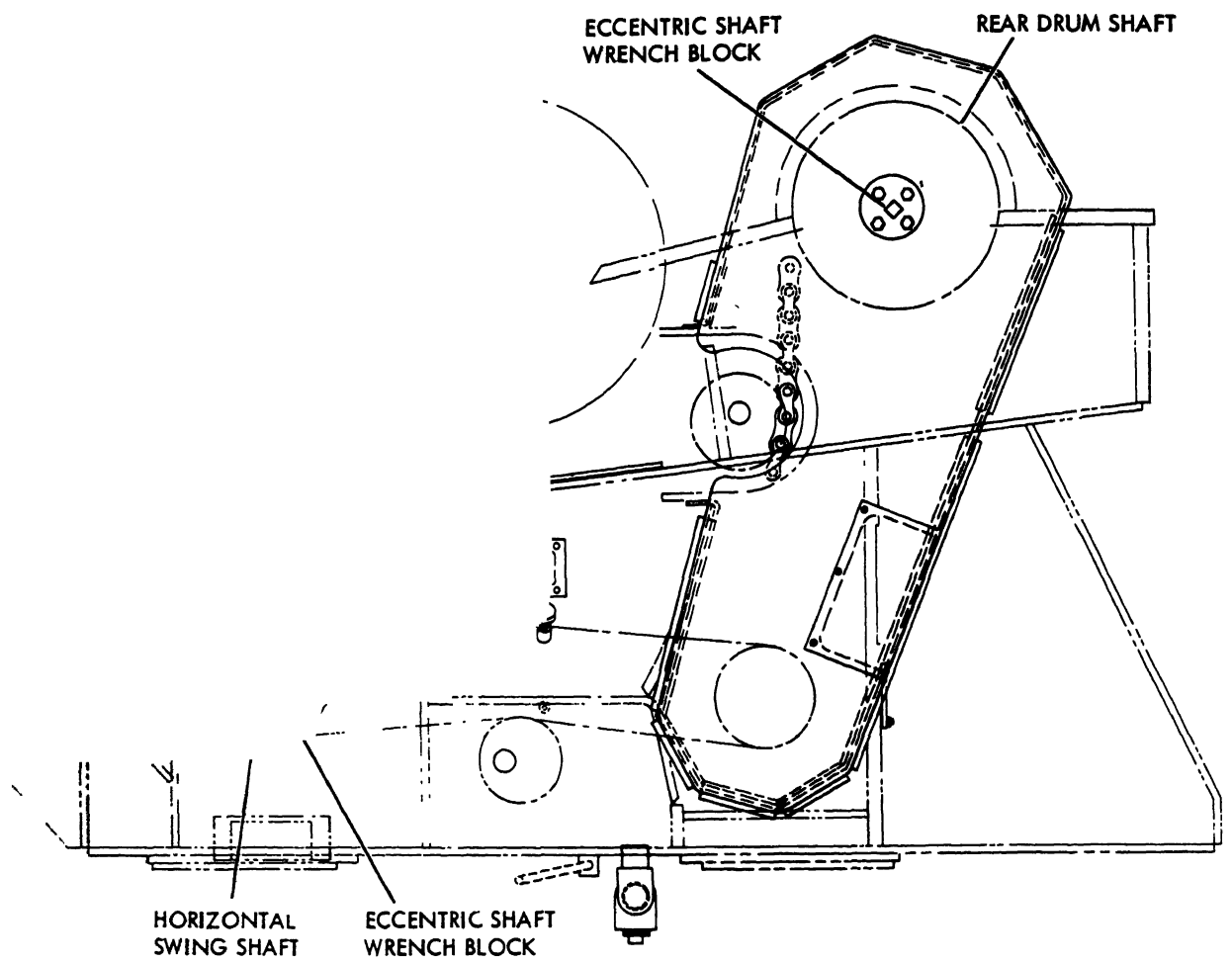


Figure 2-105.1 Adjusting front and rear drum brakes

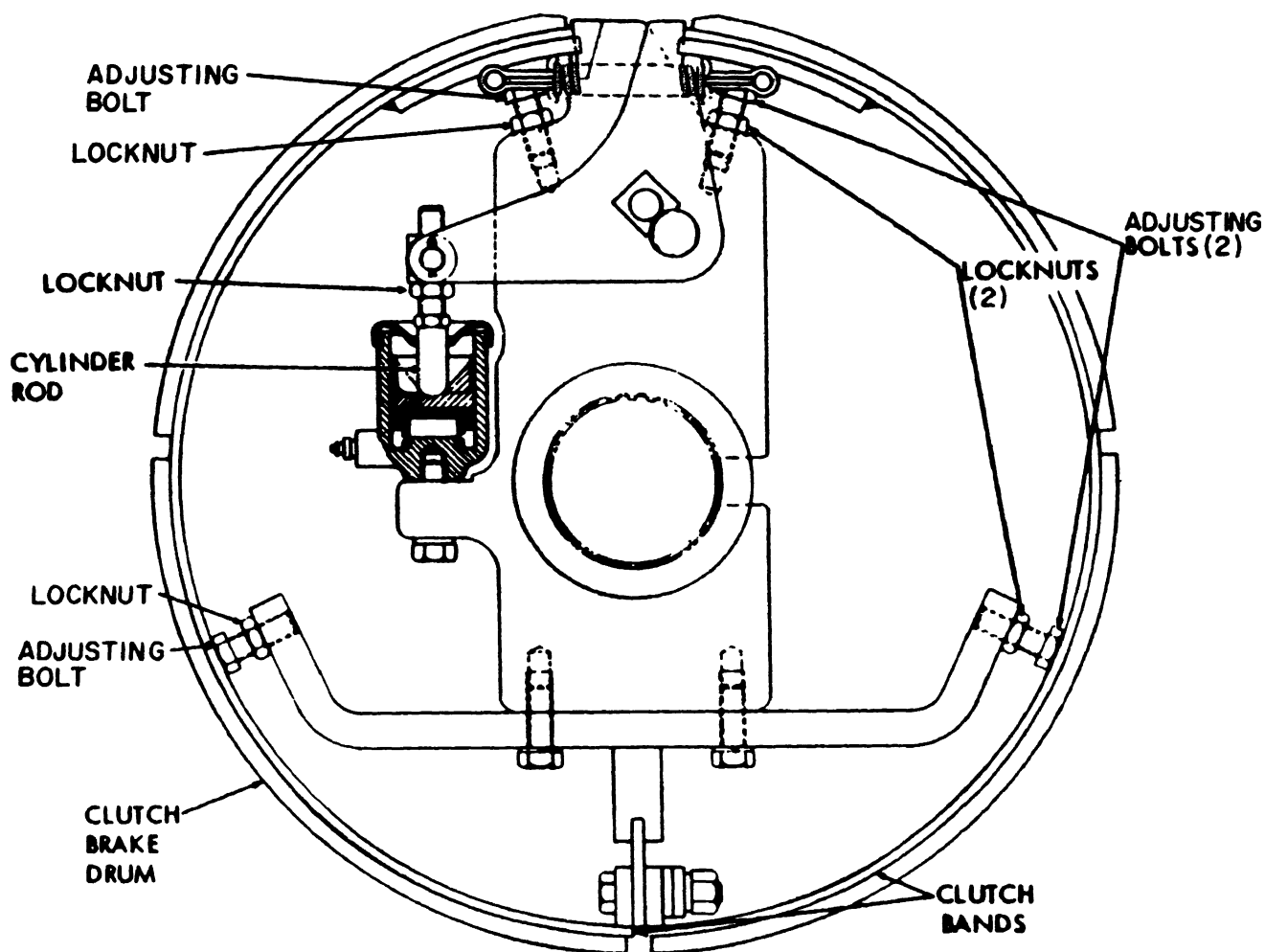


ME 3810-294-10/3-26

Figure 2-105.2. Location of chains and chain shafts.

Page 2-114, figure 2-107 is superseded as follows.

- STEP 1. LOOSEN LOCKNUTS (4) WHICH SECURE ADJUSTING BOLTS (4).
- STEP 2. TURN ADJUSTING BOLTS OUT OF CONTACT WITH CLUTCH BANDS. CLUTCH BANDS MUST BE CENTERED IN CLUTCH DRUM. USE ADJUSTING BOLTS (4) AND A FEELER GAGE TO CENTER CLUTCH BANDS. TIGHTEN LOCKNUTS.
- STEP 3. LOOSEN LOCKNUT ON CYLINDER ROD.
- STEP 4. TURN CYLINDER ROD OUT UNTIL A PULL OF 15 TO 20 POUNDS ON A SPRING SCALE IS NEEDED TO ENGAGE THE CLUTCH. TIGHTEN LOCKNUT.



NOTE: ONLY STEPS 3 AND 4 ABOVE ARE NECESSARY TO ADJUST FOR LINING WEAR. USE COMPLETE PROCEDURE ONLY WHEN CLUTCH HAS BEEN REMOVED AND REPLACED. TAO72310

Figure 2-107. Adjusting front and rear drum clutch.

Page 2-116, figure 2-109, step 2 is superseded as follows:

STEP 2. REMOVE THE PRIMARY WIRE FROM THE DISTRIBUTOR. REMOVE SPRINGS. BE THE IGNITION SWITCH IS IN THE ON POSITION.

Page 2-117, figure 2-110 is superseded as follows.

STEP 1. LOOSEN LOCKNUTS ON ADJUSTING SCREWS.

STEP 2. REFER TO FIGURE 2-32 AND ENGAGE THE SWING CLUTCH LEVER.

STEP 3. BACK OFF ON ALL ADJUSTING SCREWS UNTIL THERE IS 0.020 INCH GAP BETWEEN HEADS OF ADJUSTING SCREWS AND CLUTCH SHOES. TIGHTEN LOCKNUTS AND RECHECK GAP.

NOTE: MAKE ABOVE ADJUSTMENTS FOR FIRST ONE CLUTCH SHOE AND THEN THE OTHER. BE SURE CLUTCH SHOES DO NOT DRAG.

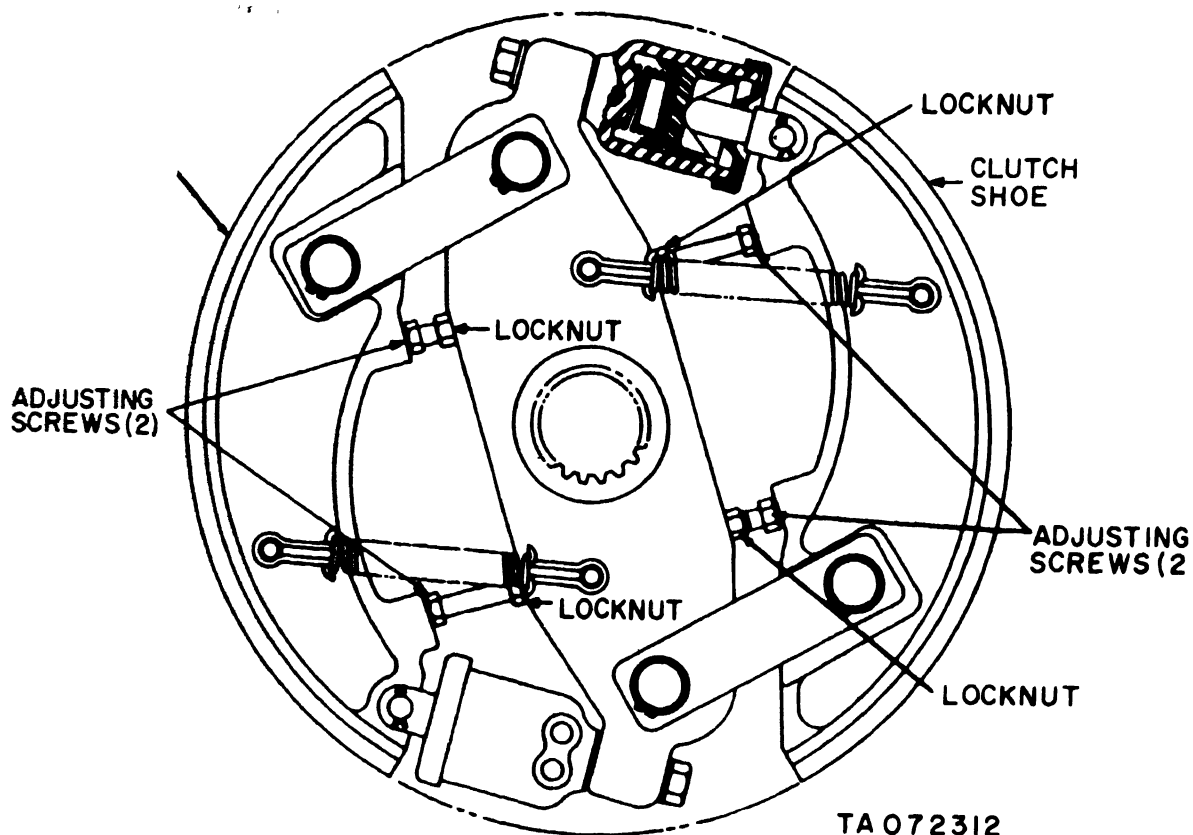


Figure 2-110. Adjusting reversing shaft clutch or horizontal swing shaft clutch.

Page 2-124. Figure 2-115 is superseded as follows.

- STEP 1. LOOSEN LOCKNUTS WHICH SECURE ADJUSTING BOLTS.
- STEP 2. TURN ADJUSTING BOLTS OUT OF CONTACT WITH CLUTCH BAND. CLUTCH BAND MUST BE CENTERED IN CLUTCH DRUMS. USE ADJUSTING BOLTS AND A FEELER GAGE TO CENTER CLUTCH BAND. TIGHTEN LOCKNUTS.
- STEP 3. LOOSEN LOCKNUT ON CYLINDER ROD.
- STEP 4. TURN CYLINDER ROD OUT UNTIL A PULL OF 15 TO 20 POUNDS ON A SPRING SCALE IS NEEDED TO ENGAGE THE CLUTCH. TIGHTEN LOCKNUT ON CYLINDER ROD.

NOTE: ONLY STEPS 3 AND 4 ABOVE ARE NECESSARY TO ADJUST FOR LINING WEAR. USE COMPLETE PROCEDURE ONLY WHEN CLUTCH HAS BEEN REMOVED AND REPLACED.

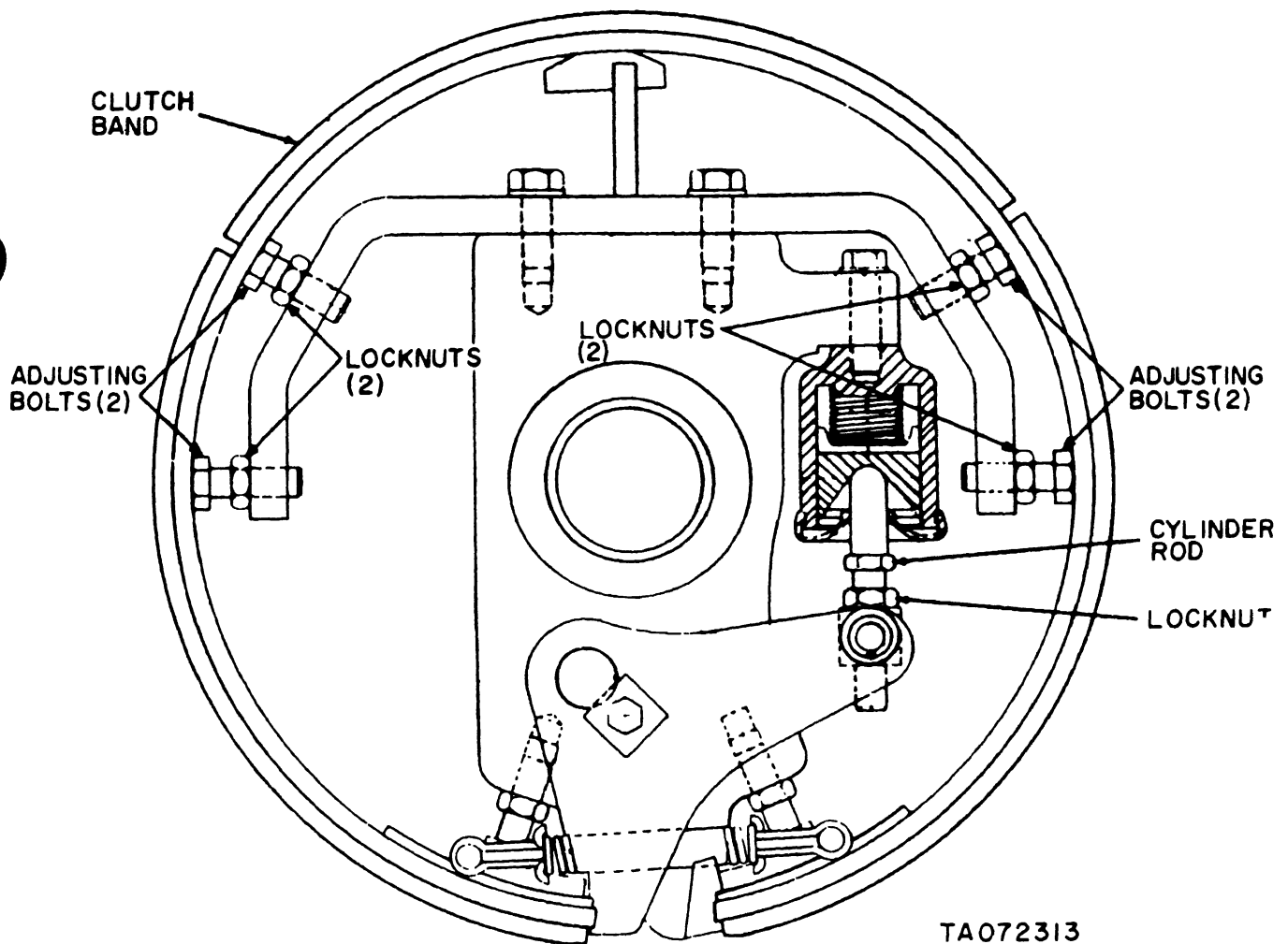


Figure 2-115. Adjusting boom hoist clutch.

Section V. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-10. General

Preventive maintenance is detecting/correcting problems before they happen, or fixing little problems before they become big problems. Table 4-1 contains a list of preventive maintenance checks and services to be performed by organizational maintenance personnel. Attention to these checks and services will increase the useful life of the carrier, but every possible problem cannot be covered in the PMCS. You need to be alert for anything that might cause a problem. If anything does look wrong, and you can't fix it, write it on a DA Form 2404 and report it to your supervisor. Be sure to record any corrective action.

4-11. Organizational Preventive Maintenance Checks and Services

a. Perform the checks and services at the intervals shown in table 4-1.

- (1) Do the (Q) checks and services once each three months.
- (2) Do the (S) checks and services twice a year, or each six months.
- (3) Do the (A) checks and services once each year.
- (4) Do the (B) checks and services once each two years.
- (5) Do the (H) checks and services at the hour interval listed.
- (6) Do the (MI) checks and services when the mileage of the vehicle reaches the amount listed.

b. If the carrier doesn't work properly and you can't see what is wrong, refer to section VI for troubleshooting instructions.

c. Make cleanup a part of your preventive maintenance. Dirt, grease, oil, and debris may cover up a serious problem. Use drycleaning solvent (SD-2) to clean metal surfaces. Wipe off excess grease and spilled oil. Use soap and water when you clean rubber or plastic material.

d. Watch for and correct anything that might cause a problem with the carrier. Some things you should watch for are:

- (1) Bolts, nuts, and screws that are loose, missing, bent, or broken.
- (2) Welds that are bad or broken.
- (3) Electric wires and connectors that are bare, broken, or loose.
- (4) Hoses and fluid lines that leak, or show signs of damage or wear.

e. You should know how fluid leaks affect the status of your equipment. Learn and be familiar with the following definitions of the types/classes of leakage. Remember—when in doubt, notify your supervisor!

Leakage definitions for PMCS are:

- CLASS I Seepage of fluid (indicated by wetness or discoloration) not great enough to form drops.
- CLASS II Leakage of fluid great enough to form drops but not enough to cause dripping from the item being checked/inspected.
- CLASS III Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

CAUTION

Equipment operation is allowable with minor leakage (Class I or II). Of course, consideration must be given to the fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.

When operating with Class I or II leaks, continue to check fluid levels as required by the PMCS.

Class III leaks should be corrected before releasing equipment for operation.

Table 4-1. Organizational Preventive Maintenance Checks and Services (CARRIER)

Item No.	Interval						ITEM TO BE INSPECTED Procedure
	Q	S	A	B	H	MI	
							<p>NOTE</p> <p>PERFORM OPERATOR/CREW PMCS PRIOR TO OR IN CONJUNCTION WITH ORGANIZATIONAL PMCS.</p>
1	•						<p>TRANSMISSION AIR FILTER</p> <p>Monthly, remove drain plug and blow out accumulated sediment. Quarterly, or each 400 operating hours, replace the element.</p>
2	•						<p>FUEL LINES AND FITTINGS</p> <p>Inspect fuel lines for leaks and tighten loose connections. Replace defective lines and fittings (para 4-39).</p>
3	•						<p>RADIATOR</p> <p>Fill to 3/4-inch above baffle plate. Replace cracked or worn hose. Tighten all mounting clamps and connections (fig. 4-12 and 4-13).</p>
4	•						<p>ENGINE DRIVE BELTS</p> <p>Adjust as required. Replace worn or frayed belts (para 4-47).</p>
5	•						<p>BATTERIES</p> <p>Check electrolyte level and specific gravity (1.285-1.300) using hydrometer, and check tightness of connections. Fill to 3/8-inch (approx) above the plates. In freezing weather, run the engine for 30 minutes after adding water. Clean vent hole in filler caps before installing caps. Replace a cracked or leaking battery (para 4-26).</p>
6	•						<p>SERVICE BRAKES</p> <p>Remove wheel. Inspect brake lining and replace brake shoes if lining is within 1/16-inch of rivets (para 4-80).</p>
7		•					<p>ENGINE CLUTCH</p> <p>Adjust if necessary (para 4-67).</p>
8	•						<p>LIGHTS</p> <p>Inspect lights for loose cables mountings, cracked lens, and proper operation. Repair or replace defective lamps or bulbs.</p>

Page 4-18. Following paragraph 4-38b(2). Add the following:

b.1. Refer to paragraph 2-78 for servicing of air cleaner.

Page A-1.

Paragraph A-5. Change "TM 9-1870-1" to "TM 9-2610-200-20".

Paragraph A-6. Change "TB 740-93-2" to "TB 740-97-2" and "TB 740-93-1" to "TM 740-90-1".

Page B-11, group 3101, column (3)H. Change "F" to "O".

Page B-21.

Group 3201, column (3)A. Add "O" to indicate maintenance function and "1.5" to indicate time standard.

Group 3202.

Column (3)A. Add "O" to indicate maintenance function and "1.5" to indicate time standard.

Column (3)H. Change "F" to "O".

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Brigadier General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-25B, Organizational maintenance requirements for C
Truck Mounted.

TECHNICAL MANUAL }
 No. 5-3810-294-20 }

HEADQUARTERS
 DEPARTMENT OF THE ARMY
 WASHINGTON, D. C., 5 April 1974

ORGANIZATIONAL MAINTENANCE MANUAL

CRANE-SHOVEL, TRUCK MOUNTED; 3/4 CUBIC YARDS; 20 TON; WITH CLAMSHELL, DRAGLINE AND BACKHOE ATTACHMENTS; G.E.D. (HARNISCHFEGER CORP MODEL M320T2)

(HARNISCHFEGER CORP MODEL M320T2)

FSN 3810-151-4431

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PART ONE CRANE (REVOLVING FRAME)

CHAPTER 1 INTRODUCTION

Section I. GENERAL

1-1. Scope

a. This manual contains instructions for the use of personnel to whom the Model M320T2 Truck-Mounted Crane is issued. It provides information on the maintenance services allocated to Organizational Maintenance by the Maintenance Allocation Chart (MAC).

b. This manual is divided into two parts. Part One primarily concerns maintenance of the crane (revolving frame) portion of the truck-mounted crane. Maintenance personnel should read the instructions provided in both parts of this manual before operating or servicing the equipment.

c. Numbers in parentheses on illustrations indicate quantity. Numbers preceding nomenclature callouts on illustrations indicate the preferred maintenance sequence.

1-2. Maintenance Forms and Records

Maintenance forms and records that you are required to use are explained in TM 38-750.

1-3. Destruction of Army Material to Prevent Enemy Use

Refer to TM 750-244-3 for procedures for destruction of equipment to prevent enemy use.

1-4. Administrative Storage

Refer to TM 7480-90-1 for information concerning administrative storage.

1-5. Reporting of Errors

You can improve this manual by calling attention to errors and by recommending improvements, using DA Form 2028 (Recommended Changes to Publications) or by letter, and mail directly to Commander, U.S. Army Mobility Equipment Command, ATTN: AMSME-MPP, 4300 Goodfellow Boulevard, St. Louis, Missouri, 63120. A reply will be furnished direct to you.

Section II. DESCRIPTION AND DATA

1-6. Description

A general description of the truck-mounted crane (figs. 1-1 and 1-2) and of its identification plates are in TM 5-3810-294-10. A more detailed description of specific components and assemblies is contained in the applicable sections of this manual. Detailed descriptions of the components of the truck-mounted crane are provided in the applicable maintenance paragraphs of this manual.

1-7. Identification and Tabulated Data

a. *Identification Plates.* Refer to TM 5-3810-294-10.

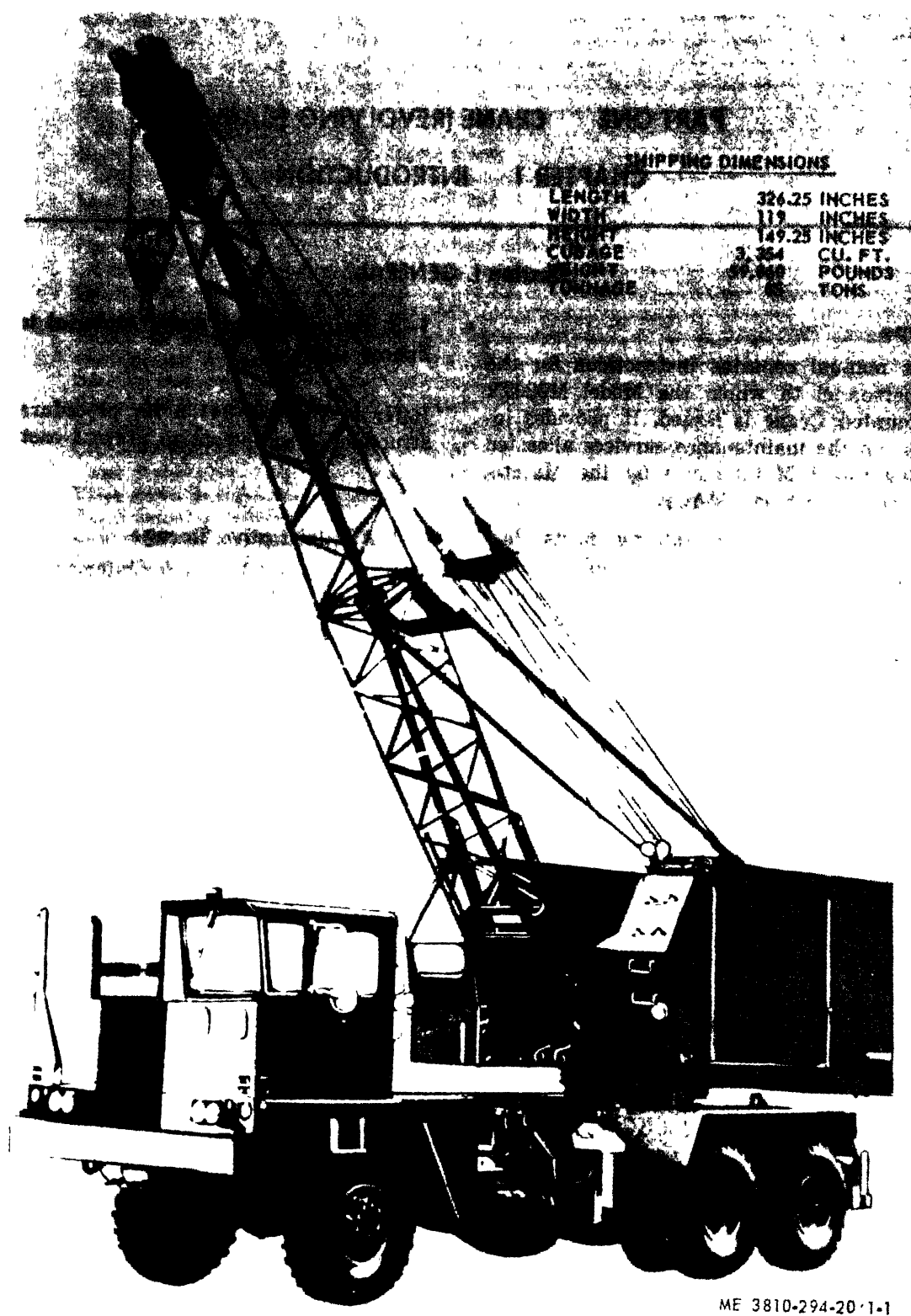
b. *Tabulated Data.*

(1) *Crane*

Manufacturer ----- Harnischfeger Corporation
Model ----- M320T2

(2) *Crane engine (fig. 1-3)*

Manufacturer ----- International Harvester
Company
Model ----- U-450
Ignition timing ----- Top dead center
Number of cylinders ----- 6
Horsepower ----- 92.5 net hp at 1800 rpm full
load
Intake valve tappet
clearance (hot) ----- 0.024-to-0.026 inch
Exhaust valve tappet
clearance (hot) ----- 0.024-to-0.026 inch
Displacement ----- 450.9 cubic inches



ME 3810-294-20-1-1

Figure 1-1. Truck-mounted crane, Model M320T2, with crane attachment, front three-quarter view, and shipping dimensions.

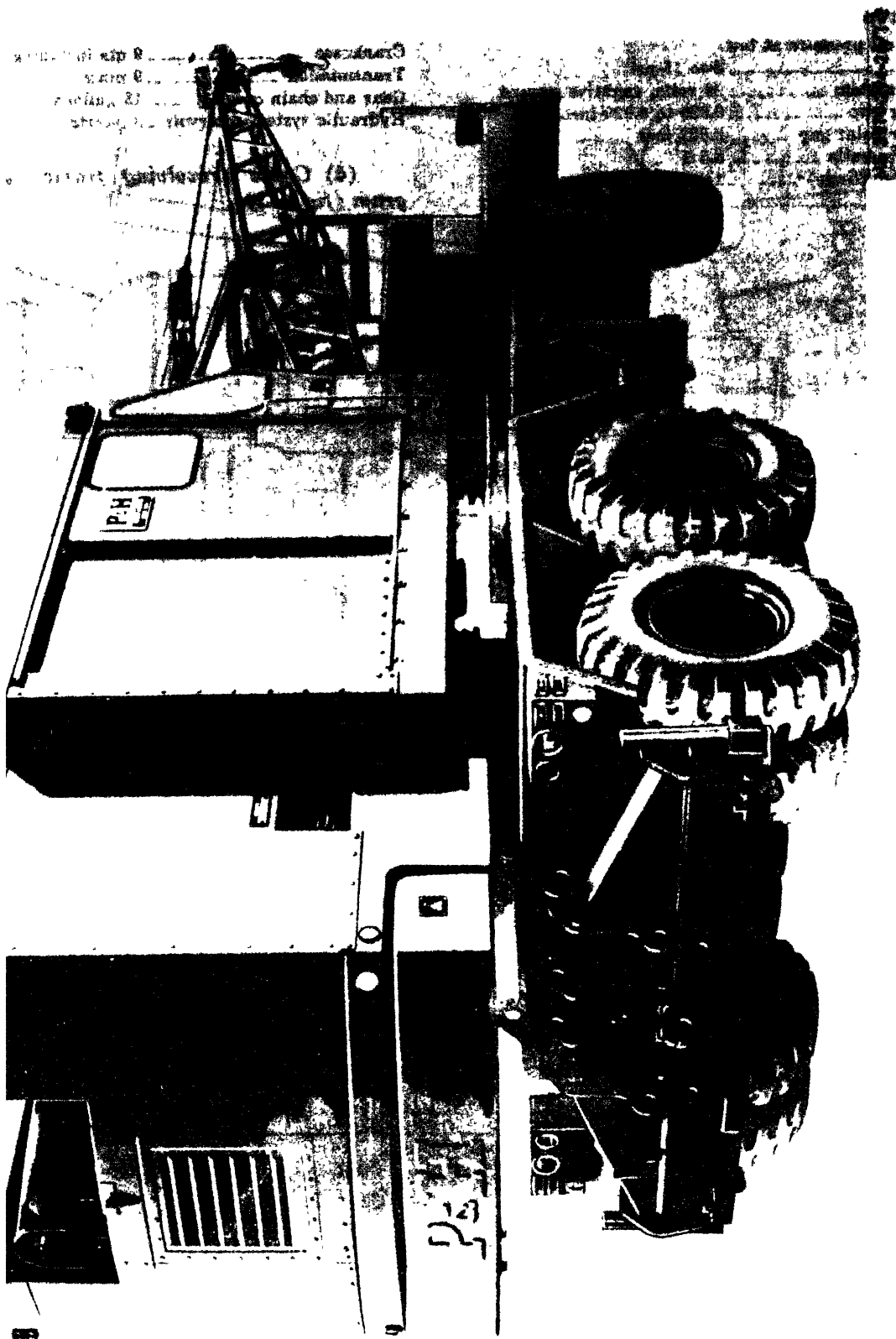


Figure 1-2 Truck-mounted crane, Model M820T2, with crane
attachment rear three-quarter view.

TM 5-3810-294-20

Governed speed 2800 \pm 25 rpm
 Low idle speed 475-to 525 rpm
 Maximum oil pressure at
 governed speed 35-to 45-psi (approx)
 Maximum oil pressure at low
 idle 8-to 15-psi
 Electrical system 24 volts, negative ground
 Spark plug gap 0.029-to 0.030-inch
 Distributor point gap 0.022 inch
 Compression ratio 6.5:1
 Compression (Gage) 145 psi at 200 rpm
 Firing order 1-5-3-6-2-4

(3) Fuel, water, and oil capacities, crane.

Engine fuel tank 50 gallons
 Cooling system 35 quarts
 Crankcase 9 qts including filter
 Transmission 9 pints
 Gear and chain case 18 gallons
 Hydraulic system reservoir - 3 quarts

(4) Crane (revolving frame) wiring diagram (fig. 1-4).

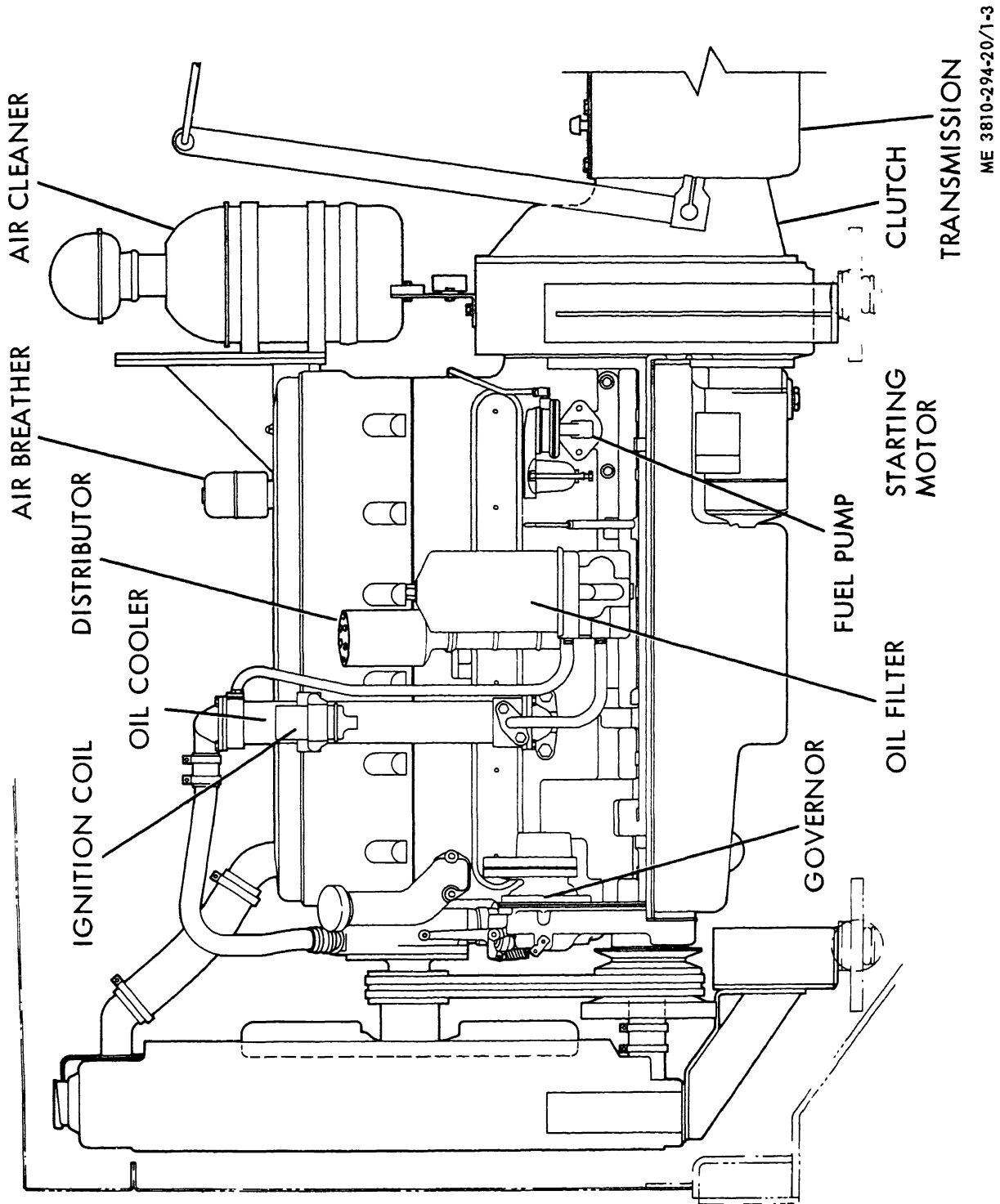


Figure 1-3. Crane engine.

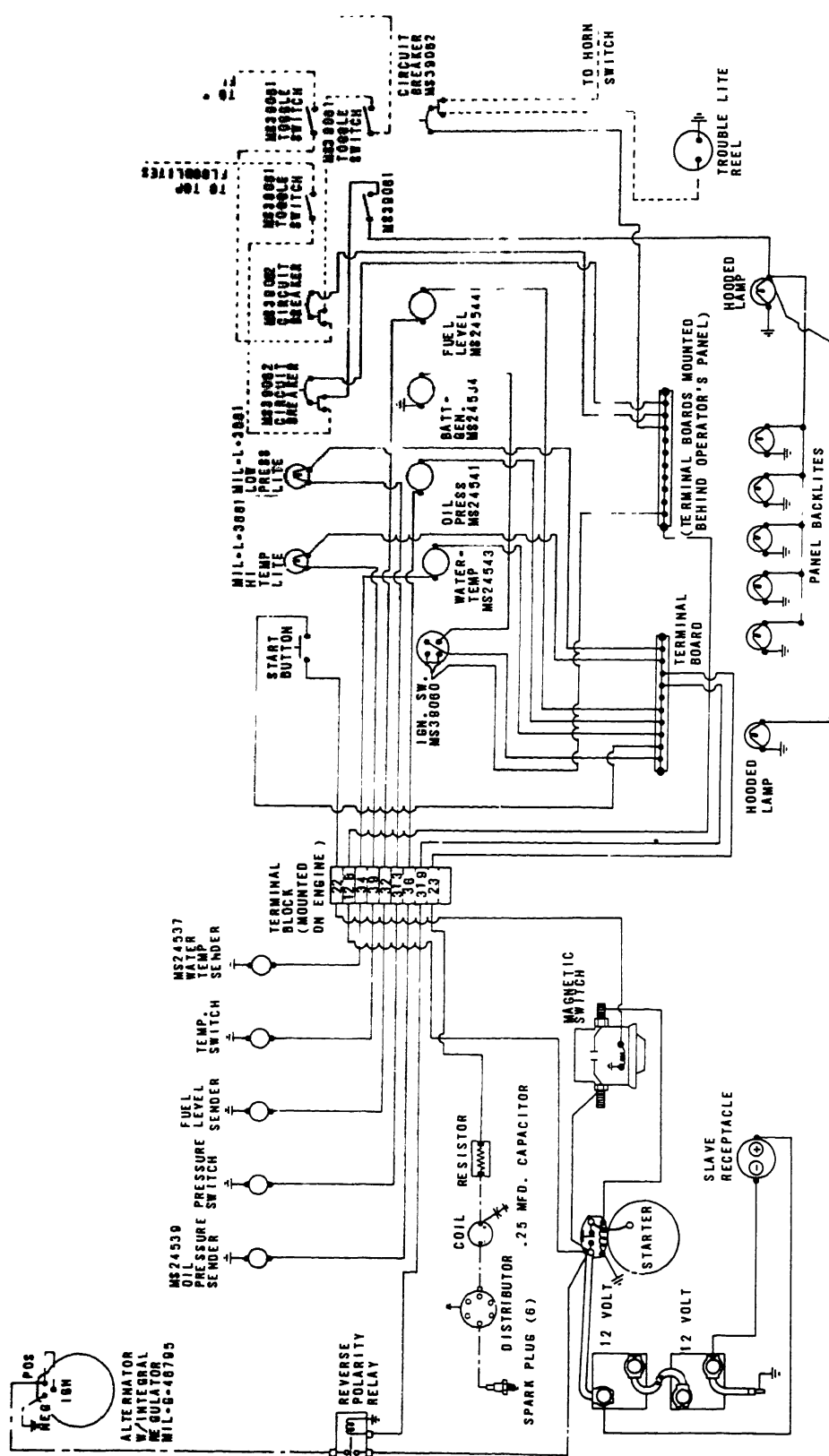


Figure 1-4. Crane (revolving frame) wiring diagram.

ME 3810-294-20/1.4

CHAPTER 2

MAINTENANCE INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIAL

I. Inspecting and Servicing the Equipment

- a. Remove all exterior material used to protect truck-mounted crane during shipment.
- b. Remove all interior protective materials, including wrapping on the operator's seats, headlights, tail lights, flood lights, and the faces of instruments.
- c. Make a complete visual inspection of the crane and carrier to see that the required publications, tools, accessories, attachments, and repair parts are with the crane and carrier.
- d. Inspect the crane and carrier for missing parts, or damage which may have occurred during loading, shipment, or unloading. Inspect the crane and carrier engines, tires, revolving-frame machinery, glass panels, and instruments for damage.
- e. Inspect all separately packaged components for damage. See figure 2-1.
- f. Inspect carrier brakes and be sure brake shoes do not stick to brake drums.
- g. Replace any missing parts.

NOTE

Make certain that the crane and carrier have been deprocessed completely before servicing.

- h. Drain the engine crankcases and oil filters and refill to the operating level with oil of the type specified in the current lubrication order (LO).
- i. Remove all tape and wrappings from the engine crankcase breathers, intake and exhaust manifolds, crane engine transmission, breather, alternator, and clutches and brakes.
- j. Check the tension on the water pump and alternator drive belts and adjust, if necessary. Refer to figure 2-2.
- k. Check the level of the lubricant in the engine gear and chain housing and add lubricant of the type specified in the current LO, if necessary. Lubricate the reversing shaft drive chain.

- l. Remove the tape or plugs from the air brake system safety valve and relay emergency valves. Close air reservoir drain cocks.

m. Remove wrappings from all machined surfaces and clean the surfaces to remove preservative coatings.

NOTE

If the LO specifies OE 10 for operation under prevailing temperature conditions, the preservative oil may be used until the first required oil change.

- n. Remove the seals from the crane and carrier battery filler caps. Remove battery material and clean the preservative coating from the terminals. Fill the batteries with the separately packed electrolyte. Check the specific gravity of the electrolyte using a hydrometer. Check to see that all electrical switches are in the OFF position and then connect the battery cables.

o. Lubricate the entire crane in accordance with the current LO.

p. Make a final complete inspection of the entire machine, looking for leaks, loose electrical connections, loose or broken hoses and lines, or any other damage or unsafe condition.

2-2. Installation

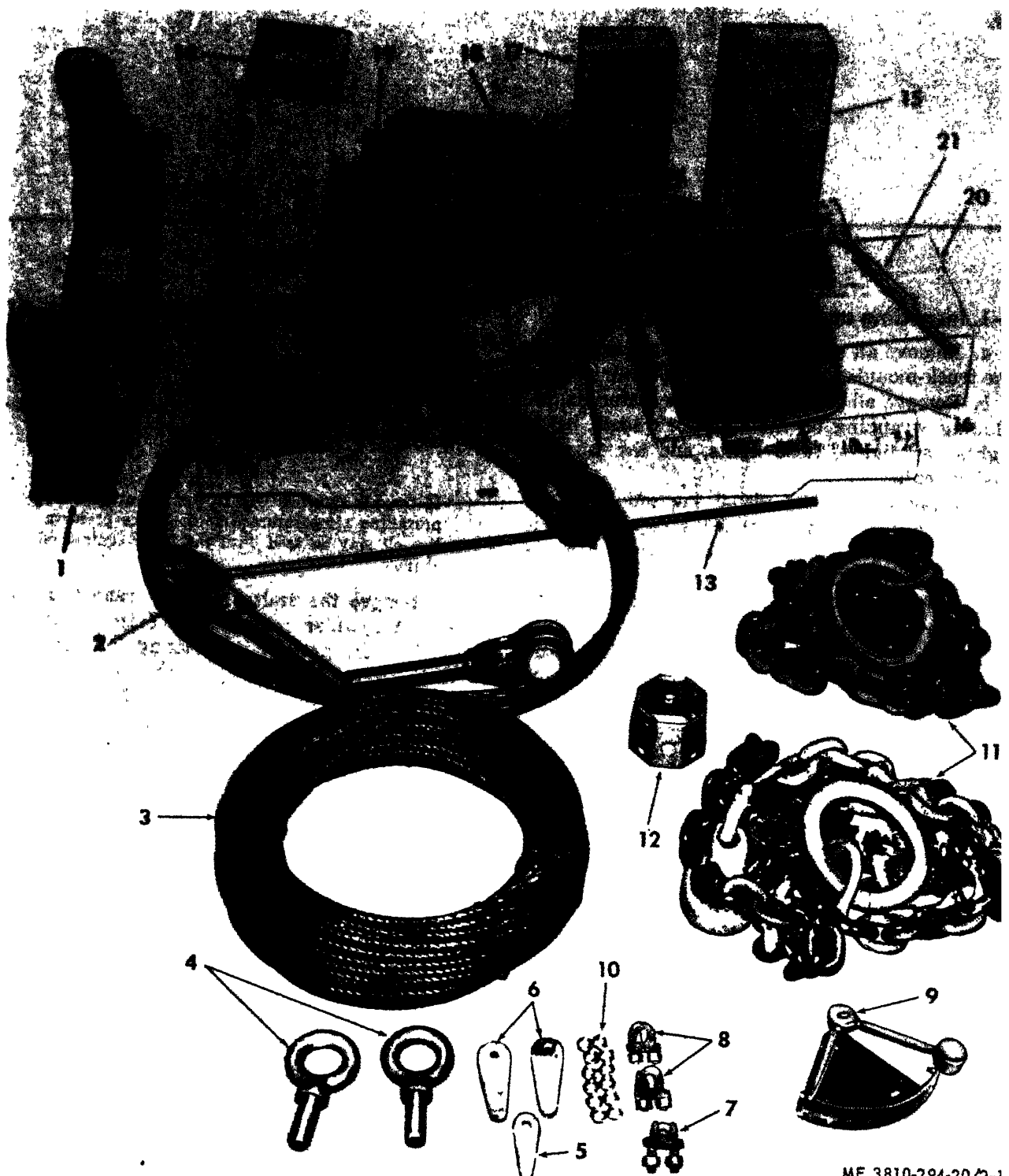
a. Refer to TM 5-3810-294-10 for installation or setting-up instructions.

b. The use of separately packaged components illustrated in figure 2-1 is covered in this manual where they would logically be installed or used.

c. Refer to equipment conversion (para 2-3, below) for instructions to install the various working attachments available for use with the truck crane.

2-3. Equipment Conversion

a. The basic crane can be converted to various uses by changing front-end attachments. The converted crane may be referred to as a crane,



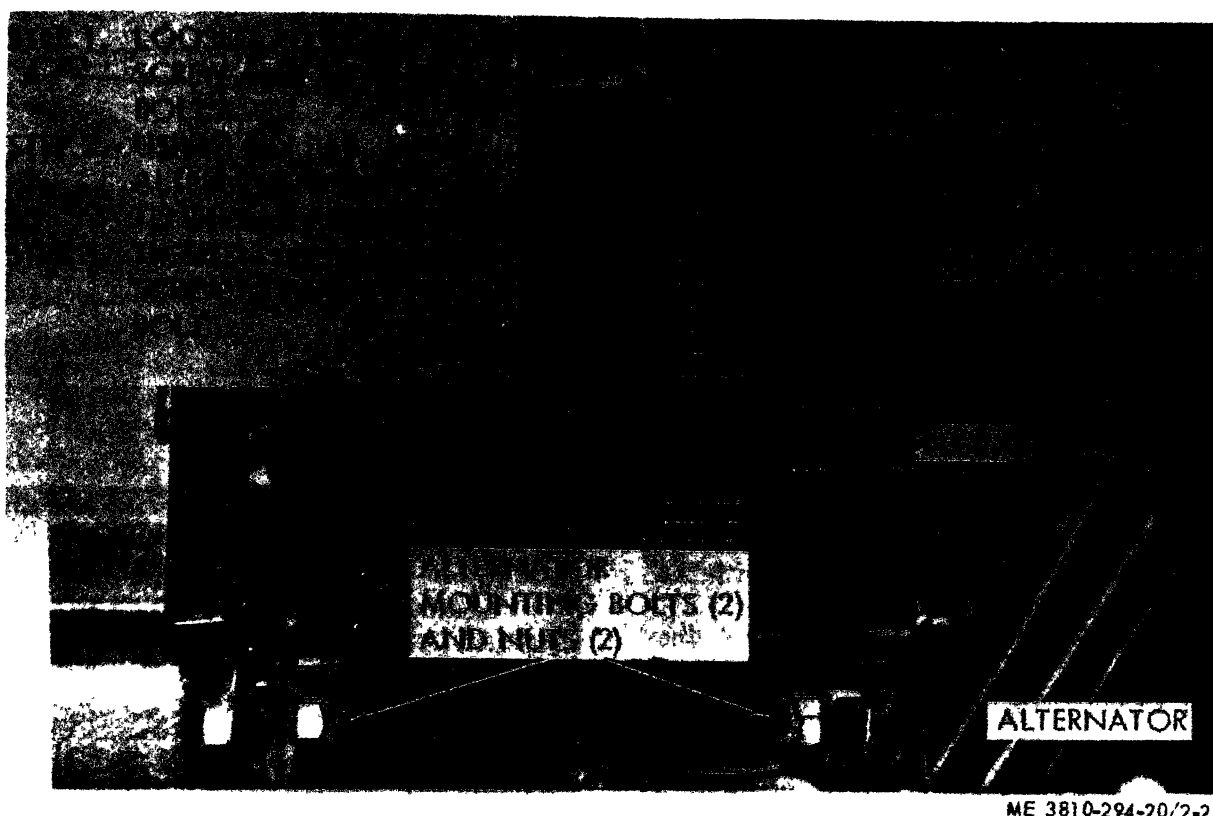
ME 3810-294-20/2-1

1. Upper spreader
2. Guy cables (2)
3. Boom hoist cable
4. Counterweight eyebolts
5. Rope wedge 1/2 inch
6. Rope wedges 5/8 inch (2)
7. Rope clamp 5/8 inch

8. Rope clamps 1/2 inch (2)
9. Boom angle indicator
10. Jam nuts (12)
11. Chains (2)
12. Wheel nut wrench
13. Jackfloat (outrigger) handle
14. Floodlights (6)

15. Fire extinguisher
16. Canvas case with operator's manual
17. Fire extinguisher
18. Hook block
19. Crane connection wire
20. Rear view mirror (2)
21. Windshield wiper

Figure 2-1. Separately packaged components.



ME 3810-294-20/2-2

Figure 2-2. Alternator and water pump belt tension adjustment.

clamshell, dragline, piledriver, backhoe, or shovel. The various conversions are described in paragraphs 2-4 through 2-9.

b. When a conversion is anticipated, make certain that all required attachments, tools, blocking, a suitable lifting device, and maintenance personnel are available.

c. Before reeving any line, lay out the line so that there is no possibility of kinking during the reeving process. Refer to TM 5-3810-294-10 for information on handling and maintenance of cables.

NOTE

When wrapping new cable on a drum, wrap the cable slowly and make certain that the cable wraps evenly on the drum the first time.

2-4. Crane Conversion

a. *General.* The crane may be converted to crane operation by installing the crane front-end assembly. The following components are necessary for the equipment conversion: one 15-foot boom base section, one 15-foot point section, boom foot pins, boom guy cables, boom hoist

cable, boom backstops, hoist line, and hook block. The basic crane boom may be extended by installing boom inserts between the boom base section and the boom point section. The boom inserts are in 10-foot lengths and must be for the specific boom installed so that the connecting joints of the boom and insert match.

NOTE

Longer guy cables are necessary when the length of the boom is increased. Refer to cable specifications in TM 5-3810-294-10.

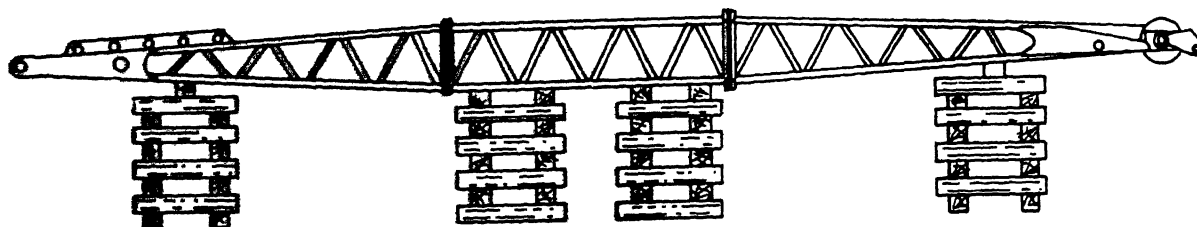
b. Boom Installation.

NOTE

To install the boom, a cribbing will be necessary to support the boom in a horizontal position. The cribbing must be high enough to bring the boom into position with the boom foot lugs on the revolving frame as shown in figure 2-3.

(1) Lift boom sections into place on cribbing.

(2) Refer to figure 2-4 and install the boom connection capscrews, lockwashers, and locknuts so that the boom base section, insert



ME 3810-294-20 2-3

Figure 2-3. Cribbing prepared for boom assembly and installation.

(if used), and point section form a complete assembly.

(3) Carefully move the carrier up to the cribbed boom so that the bores in the boom foot lugs on the revolving frame are aligned with the bores in the boom base section.

(4) Refer to figure 2-5 and install the boom foot pins.

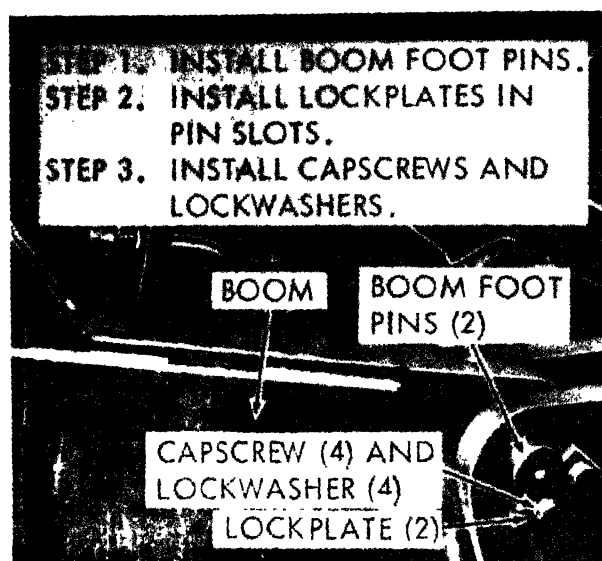
(5) Install the boom backstops between the gantry and boom as shown in figure 2-6.

c. *Crane Boom Angle Indicator Installation.* Refer to figure 2-7 and install the boom angle indicator.

d. *Boom Hoist Cable Reeving.*

(1) Use a suitable lifting device and lift the upper spreader into position on the boom.

(2) Install the two guy cables (fig. 2-8). Secure one end of each cable to the boom point and the other end to the upper spreader with pins. Secure the pins with cotter pins.



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Figure 2-5. Installing boom foot pins.

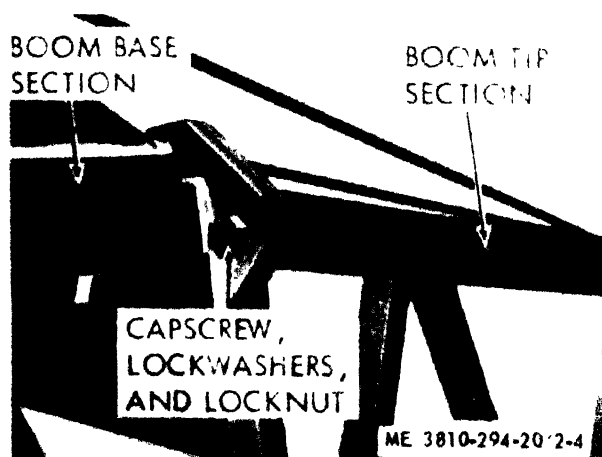
(3) Install the gantry spreader on the gantry A-frame.

(4) Unroll and stretch the boom suspension cable out on the ground on the right side of the boom.

(5) Begin at the upper spreader center sheave, as illustrated in figure 2-9, and reeve the left side of the upper spreader and lower spreader as shown. End at the dead end socket on the gantry A-frame.

(6) Beginning at the upper spreader center sheave, reeve the right side of the upper spreader and lower spreader as shown in figure 2-9.

(7) Secure the boom hoist line to the boom hoist drum, as shown in figure 2-10, and spool the slack cable on the drum.



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Figure 2-4. Connecting boom sections.

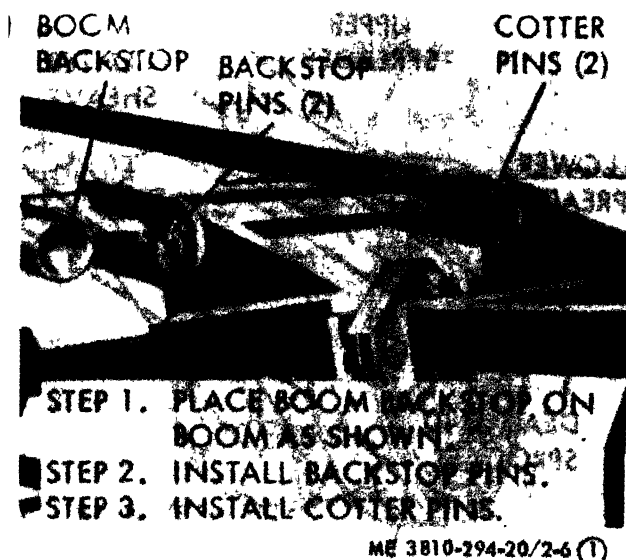


Figure 2-6. Boom backstop installation.
(Sheet 1 of 2)

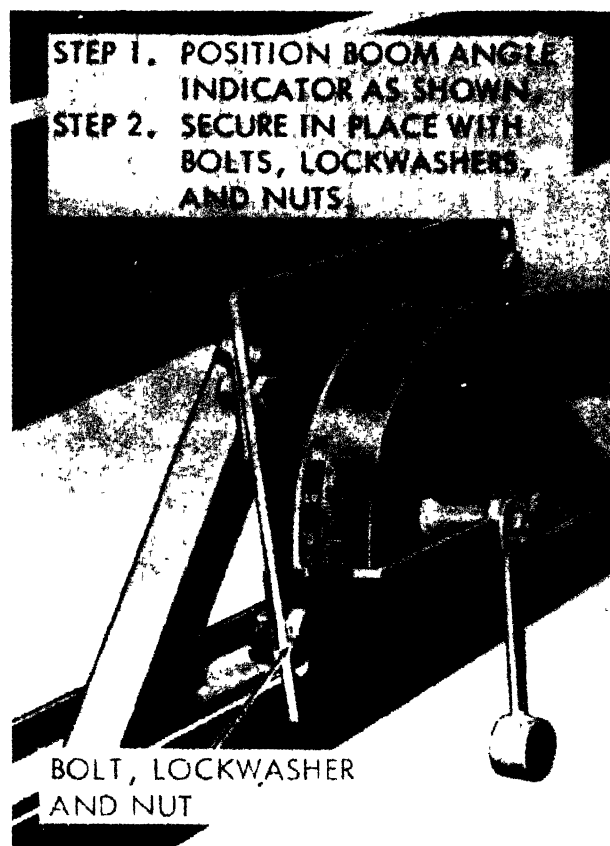


Figure 2-7. Crane boom angle indicator installation.

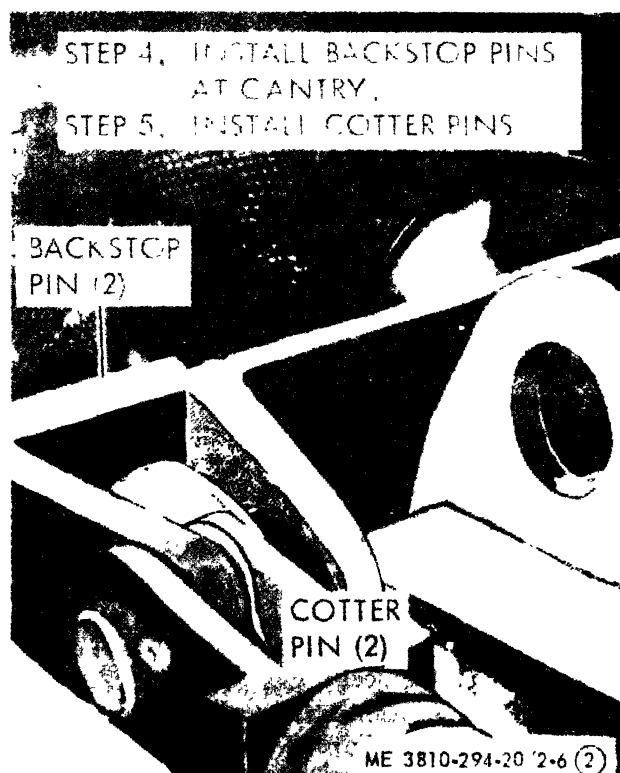


Figure 2-6. Boom backstop installation. (Sheet 2 of 2)

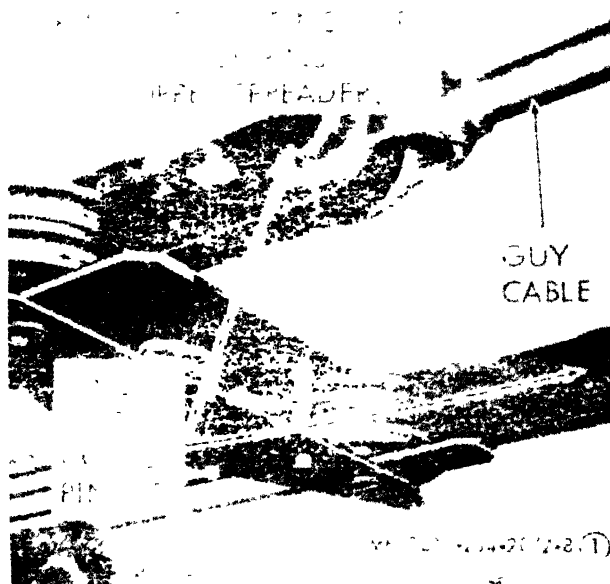


Figure 2-8. Guy cables, installation (Sheet 1 of 2).

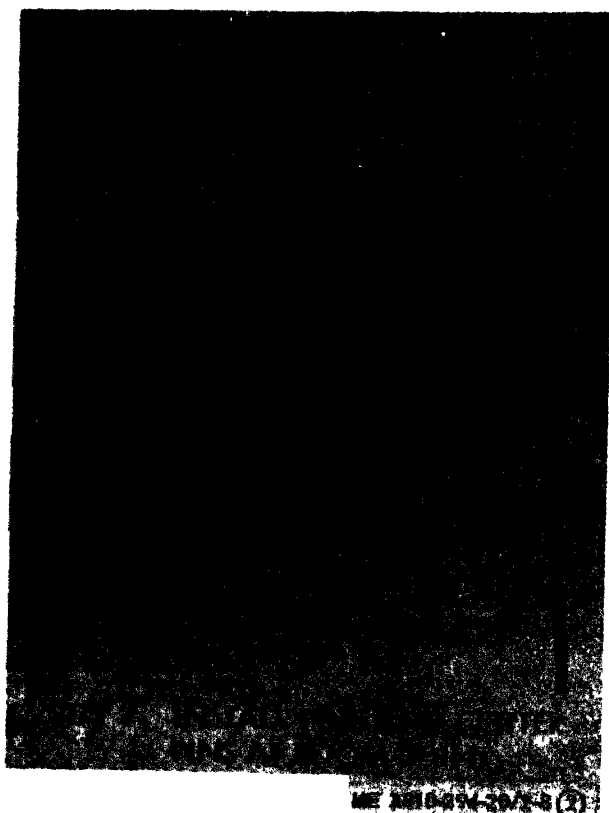


Figure 2-8. Guy cables, installation (Sheet 2 of 2).

e. Main Hoist Line Reeving (Fig. 2-11).

NOTE

The number of parts of line (from one to five) used on the main hoist line depends on the weight of the loads to be lifted and the line speed desired. For maximum speed of operation, use no more parts of line than are required for the loads to be lifted, within the limitations shown on the rating plate in the crane cab.

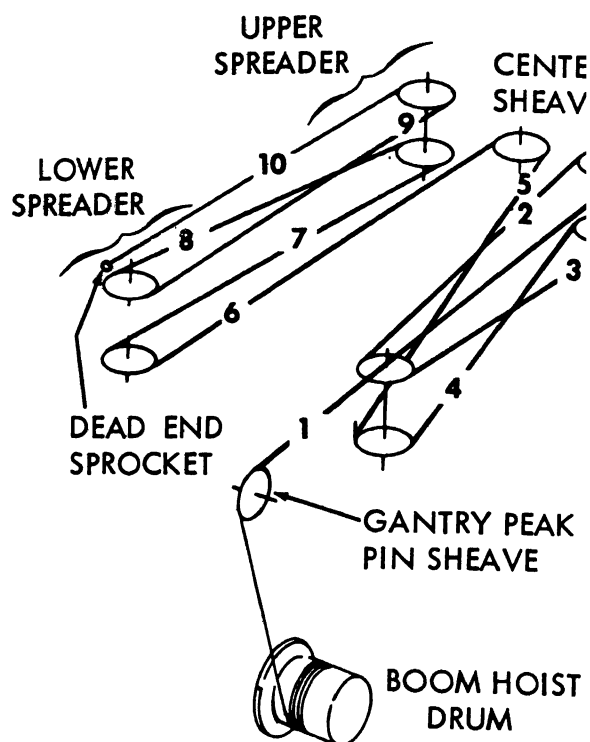
(1) Reeve main hoist line on rear main drum and reeve secondary hoist line (if used) on front main drum. If jib is used, reeve jib line on rear main drum, and main hoist line on front main drum. Secure hoist lines to drums as shown in figure 2-11.

(2) A single-part line is reeved over center boom point sheave, directly to a weighted hook, and is dead-ended at the hook.

NOTE

A weighted hook must be used for single-line operation, instead of a hook block.

(3) A two-part line is reeved over center boom point sheave, around one hook block sheave, and dead-ended at boom point.



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Figure 2-9. Boom hoist line reeving.

(4) A three-part line is reeved over 1 boom point sheave, around a hook block sheave, around right boom point sheave, and dead-ended at hook block.

(5) A four-part line is reeved over 1 boom point sheave, around left hook block sheave, around right boom point sheave, around right hook block sheave, and dead-ended at boom point.

(6) A five-part line is reeved over 1 boom point sheave, around left hook block sheave, around center boom point sheave, around right hook block sheave, around right boom point sheave, and dead-ended at hook block.

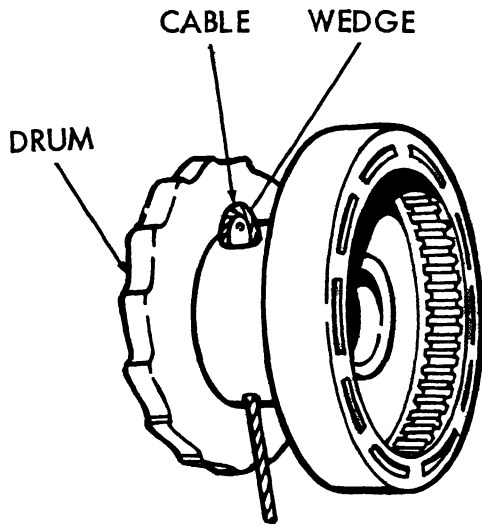
f. Unreeving the Hoist Line.

(1) Lower hook block to the ground. Lower boom until boom point is approximately five feet from ground.

(2) Remove cable from dead-end socket at boom point or hook block.

(3) Unreeve cable from hook block at boom point sheaves.

(4) Release drum brake and pull cab from drum. Remove cable wedge from cab drum socket and free cable.



ME 3810-294-20/2-10

Figure 2-10. Securing cable to drum.

(5) Pull cable free of cable drum and boom point sheave and lay it out straight on ground.

(6) Roll cable into a coil and secure with wire. Label the cable for future use.

g. Unreeving the Boom Hoist Cable.

(1) Swing revolving frame so that the boom is over rear of carrier. Lower boom to horizontal position, level with carrier.

(2) Build up cribbing under boom as shown in figure 2-3.

(3) Lower boom to rest on cribbing and continue to slack off on boom hoist cable until upper spreader comes to rest on boom.

(4) Unspool boom hoist cable from drum. Remove wedge from cable drum socket and free cable.

(5) Disconnect cable dead-end at gantry and free cable. Refer to figure 2-9.

(6) Unreeve boom hoist cable from gantry spreader and upper spreader sheaves.

(7) Lay cable out straight on ground.

(8) Roll cable into coil and secure with wire. Label the cable for future use.

(9) Remove guy cables by removing cotter pins and pins from both ends of cables. Refer to figure 2-8.

(10) Using a suitable lifting device, lift upper spreader from crane boom.

h. Removing the Crane Boom.

(1) Unreeve hoist line and boom hoist line. Support boom on cribbing as shown in figure 2-3.

(2) Use wedges or hydraulic jack to relieve weight of boom on boom foot pins and remove pins. Refer to figure 2-5.

(3) Disconnect boom backstops from gantry A-frame and lay backstops on top of boom. Refer to figure 2-6.

(4) Drive carrier away from boom.

2-5. Clamshell Conversion

a. General. The crane may be converted to clamshell operation by installing the crane boom (para 2-4) and a clamshell bucket. The following components are necessary for equipment conversion: crane boom components (para 2-4), clamshell bucket, bucket holding and closing lines, tagline winder, and tagline.

NOTE

The crane hoist cable may be used for the bucket holding line, but if additional depth below ground level is desired, longer holding and closing lines must be installed. Refer to cable specifications in TM 5-3810-294-10.

b. Installation. Install the crane boom, backstops, and boom hoist cable as described in paragraph 2-4.

c. Reeving.

(1) Swing crane boom over clamshell bucket. Lower boom to approximately six feet above ground beside clamshell bucket.

(2) Reeve the closing line on clamshell around left boom point sheave and to rear hoist drum. Secure line to drum (fig. 2-10) and wrap sufficient line on drum to close clamshell bucket.

(3) Reeve the holding line around right boom point sheave and to front hoist drum. Secure line to drum and wrap line on drum until same number of turns are on both drums. Attach holding line loosely to clamshell bucket.

(4) Raise boom to working angle. Raise clamshell bucket, using both lines, until the second layer begins on rear (closing line) drum. The second layer should begin on the front drum at the same time. If it does not, adjust the point of attachment of holding line to bucket.

(5) Cut both lines and secure them to bucket.

d. Tagline Winder.

(1) Using a suitable lifting device, lift tagline winder into position between chords of boom base section, near upper end of section.

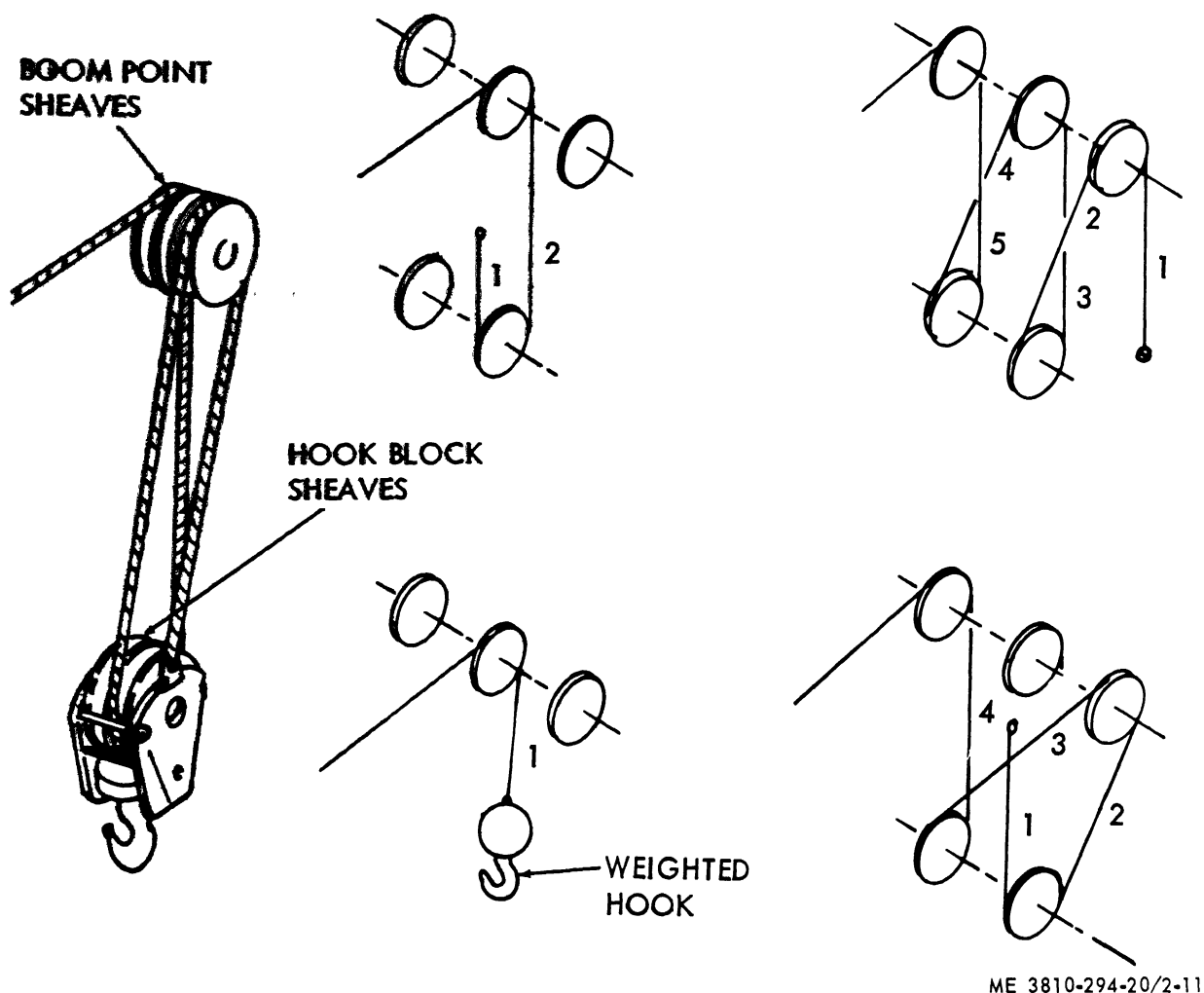


Figure 2-11. Main hoist line reeving.

NOTE

Where there is no interference with machine operation, mount tagline winder with the cable drum on side away from operator to reduce interference with operator's vision.

(2) Position tagline winder at angle on boom so that tagline drum is in line with boom point and so that tagline will reel straight off drum when clamshell bucket is at half the height of boom point (fig. 2-12).

(3) Secure tagline winder to boom, using wood filler blocks as necessary.

NOTE

The tagline winder should be left on boom when not in use.

e. Unreeving the Clamshell.

(1) Release drum brakes and unspool the holding and closing cables from front and rear drums.

(2) Remove cable wedges from dead-end sockets on clamshell and remove closing and holding cables.

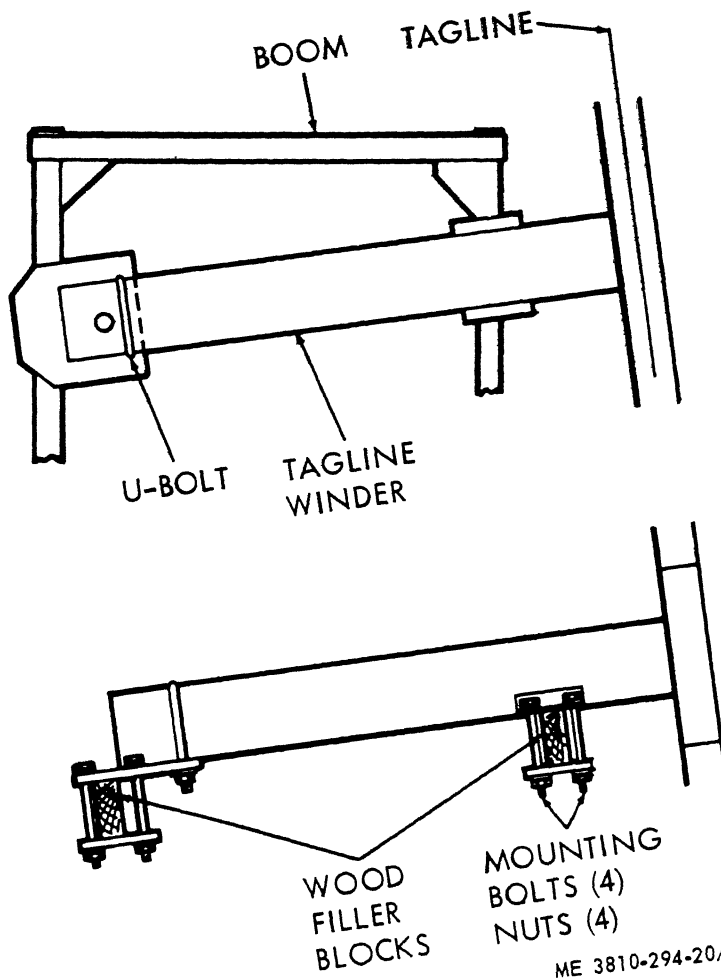
(3) Remove cable wedges from both cable drums and free the closing and holding cables.

(4) Pull cables free of drums and boom point sheaves and lay them out straight on ground.

(5) Roll cables into a coil and secure them with wire. Label cables for future use.

(6) Remove boom hoist cable and boom (para 2-4).

- STEP 1. UNREEVE TAGLINE (PARA-GRAPH 2-5e).
- STEP 2. REMOVE U-BOLT.
- STEP 3. REMOVE MOUNTING BOLTS AND NUTS.



ME 3810-294-20/2-12

Figure 2-12. Tagline winder installation.

2-6. Dragline Conversion

a. *General.* The crane may be converted to dragline operation by installing the crane boom (para 2-4) and a dragline bucket. The following components are necessary for equipment conversion: crane boom components (para 2-4), drag bucket, bucket hoist and drag lines, and fairlead.

NOTE

The crane hoist cable may be used for the bucket hoist line, but if additional reach and depth are desired, a longer cable must be installed. Refer to cable specifications in TM 5-3810-294-10.

b. Installation and Reeving.

- (1) Install crane boom, backstops, and boom hoist cable as described in paragraph 2-4.
- (2) Install the fairlead (fig. 2-13).
- (3) Reeve the hoist cable over center boom point sheave and secure it to the rear drum. Secure remaining free end to cable socket on dump sheave chain (fig. 2-14).

NOTE

When inserting the cable end back into the cable socket, do not let it protrude on the opposite side more than one inch.

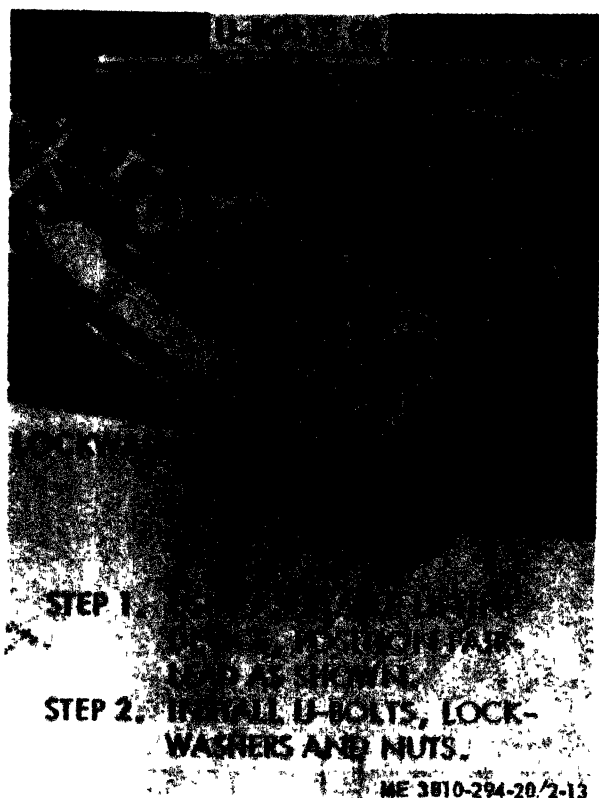


Figure 2-13. Fairlead installation.

(4) Reeve the drag cable through the fairlead and secure it to the front drum. Reeve remaining free end through the three-way socket and secure it.

(5) Insert one end of bucket dump cable through the three-way socket and secure it with cable wedge. Reeve the remaining free end over the dump sheave, down to the bucket arch, and dead-end the cable.

(6) The bucket teeth should be approximately 12 inches higher than heel of bucket when bucket is suspended in midair and drag cable is pulled tight. Remove dump cable from dead-end socket at top of bucket arch and lengthen or shorten it, if necessary.

c. Removing and Unreeving.

(1) Lower dragline bucket onto wood blocking.

(2) Remove cable wedges from three-way socket and dead-end socket on bucket arch. Unreeve bucket dump cable from dump sheave.

(3) Pull the hoist and drag cables free of drag bucket, and unspool cables from front and rear drums.

(4) Remove cable wedges from both drums and free the hoist and draglines. Pull cables free of drums and boom point sheaves.

(5) Lay the hoist, drag, and bucket dump cables straight on the ground. Roll cable coils and secure them with wire. Label coils for future use.

(6) Remove fairlead (fig. 2-13).

(7) Remove boom hoist cable and boom (para 2-4).

2-7. Piledriver Conversion

a. *General.* The crane may be converted to piledriver operation by installing the crane boom and the piledriver. Paragraph 2-4 lists the boom components required. The piledriver consists of the catwalk, piledriver guides, hammer and leads.

b. Installation.

(1) Install crane boom, backstops, boom hoist cable as described in paragraph 2-4.

(2) Place lead sections on a flat surface in a horizontal position. Bolt one top lead section and four lower lead sections together. Refer to figure 2-15.

(3) Lower boom to horizontal position line with upper end of lead assembly and secure to outside of adapter plates on boom point. Refer to figure 2-16.

(4) Install hammer cable in drum socket on front cable drum and secure with cable wedge. Lead the hammer cable from drum out over left boom point sheave. Refer to figure 2-17.

(5) Install pile hoist cable in drum socket on cable drum and secure with cable wedge. Lead the pile hoist cable from drum out over right boom point sheave.

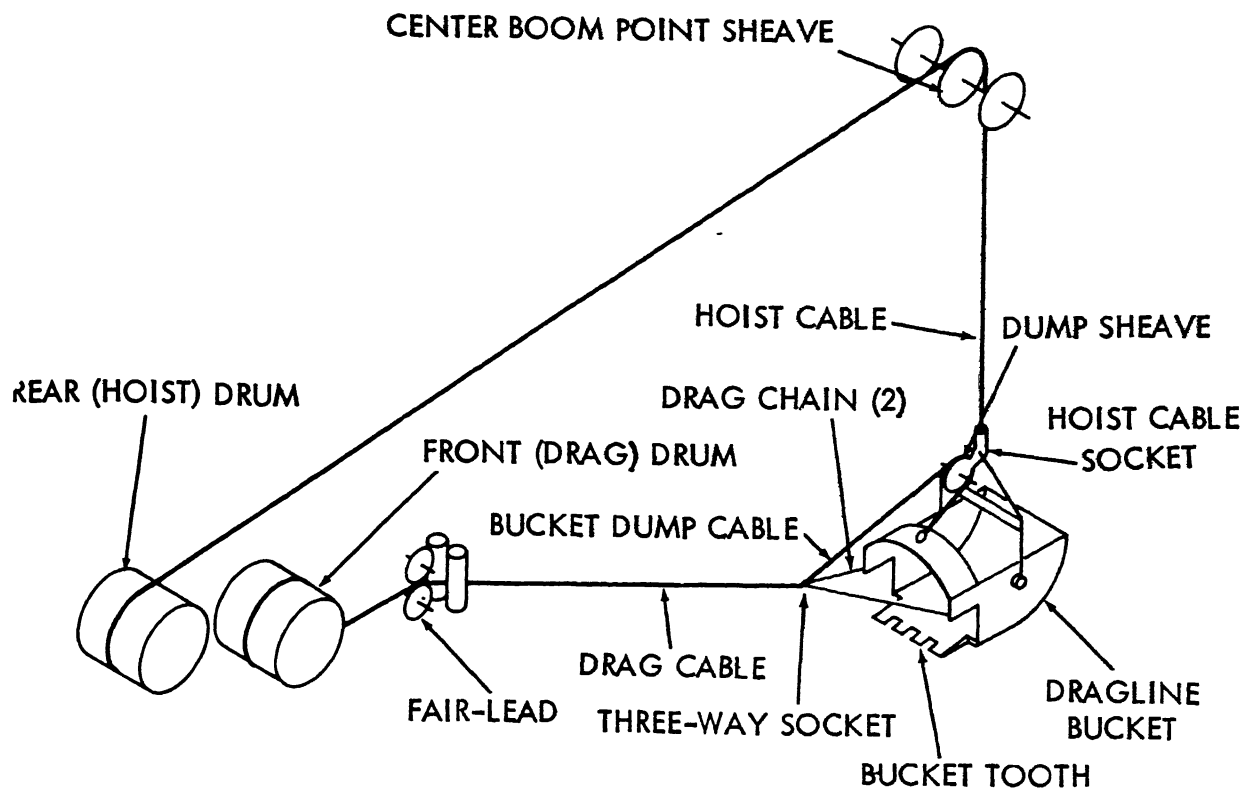
(6) Install a thimble and the pile hoist cable through pile hook and secure with thimble cable clamps.

(7) Back crane slowly toward the piledriver leads at the same time hoisting the boom until the leads are vertical.

(8) Raise boom until bottom of leads is in line with the hammer and position leads over the hammer.

(9) Secure piledriver hammer (rear drum cable to the eye on top of hammer with a cable wedge, pin, and cotter pins and raise the hammer into the leads.

(10) Swing boom into position over the cap. Lower hammer and secure pile cap to hammer with the cable sling. Raise hammer and the cap into the leads.



ME 3810-294-20/2-14

Figure 2-14. Dragline reeving diagram.

(11) Refer to figure 2-16 and install catwalk to foot of boom and the leads; adjust catwalk so the leads are vertical, and bolt catwalk sections together.

c. Removing the Piledriver.

(1) Lower hammer enough to allow slack in cable sling. Remove sling and move piledriver clear of cap.

(2) Remove bolts and nuts securing the catwalk sections. Raise boom enough to clear hammer and lower hammer to ground. Remove cable from hammer.

(3) Remove bolts securing catwalk to leads and boom and lower catwalk to ground.

(4) Lower leads to ground and slowly drive carrier forward; at same time, lower boom to the wood blocks.

(5) Remove piledriver lead adapters and leads as shown in figures 2-15 and 2-16. Secure pile lead adapters to leads.

(6) Remove boom hoist cable and boom (para 2-4).

2-8. Backhoe Conversion

a. General. The crane may be converted to backhoe front-end attachment. The following components are necessary for equipment conversion: backhoe boom, dipper handle, backhoe bucket, pitch brace, drag padlock sheave, hoist padlock sheave, gantry mast, boom foot pins, boom hoist cable, pull cable, and mast suspension cable.

b. Installation.

NOTE

To install the backhoe boom, a cribbing will be necessary to support the boom in a horizontal position. The cribbing must be high enough to bring the boom into position with the boom foot lugs on the revolving frame as shown in figure 2-18.

(1) With base of backhoe boom assembly cribbed up to height of boom foot lugs on revolving frame, swing revolving frame to face the rear of carrier. Carefully back carrier up to cribbed up boom so that the bores in boom foot lugs on revolving frame are aligned with bores

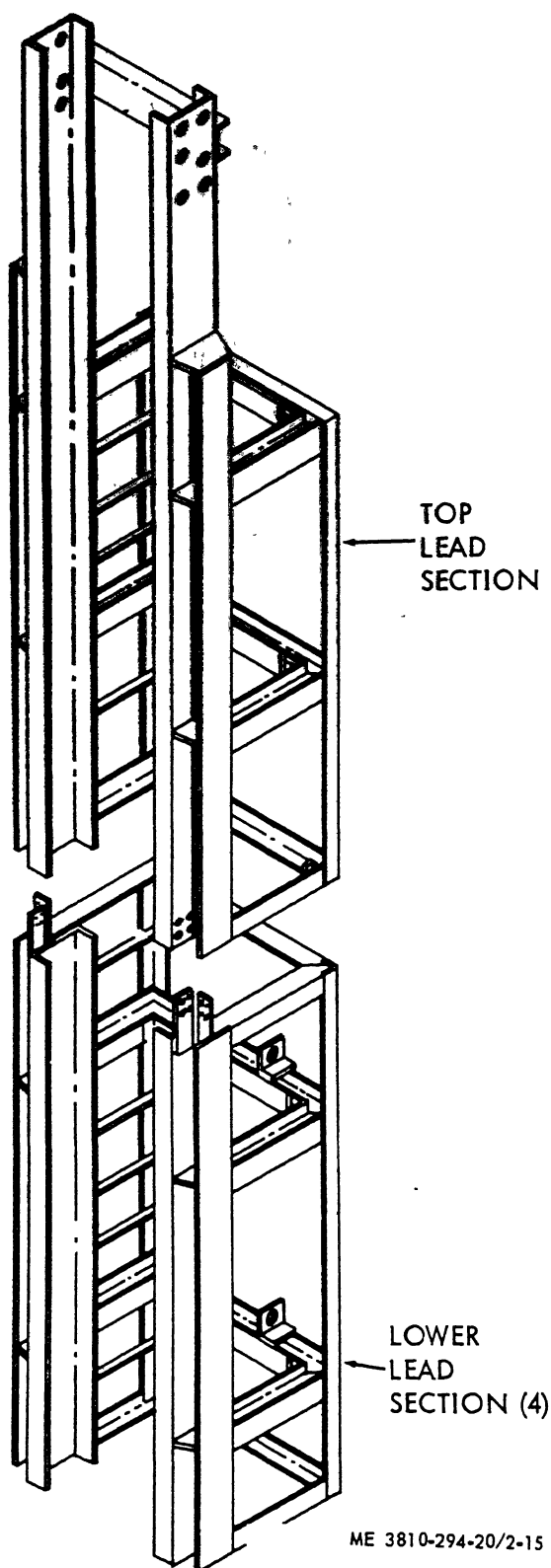


Figure 2-15. Assembling piledriver lead sections.

in backhoe boom foot. Install boom to revolving frame with boom foot pins and lock plates.

(2) Skid the gantry mast along on top boom into place on revolving frame. Make certain the small cable guide sheave at top of gantry mast points toward the crane, and install the gantry mast foot pins.

(3) Raise the gantry frame by hand and lean it against the crane cab.

c. Reeving.

(1) Unroll and stretch the gantry suspension cable out on ground on right side of boom.

(2) Reeve the backhoe auxiliary gantry cable as shown in figure 2-19.

(3) Secure gantry suspension line to the boom hoist drum as shown in figure 2-10. Spool the slack cable on the drum.

(4) Install the gantry frame hold down cable (1/2 in. dia. x 8 ft., 6 in. lg.) between revolving frame and upper end of gantry frame.

(5) Unroll and stretch the digging cable out on the ground on right side of boom.

(6) Reeve the digging cable as shown in figure 2-20.

(7) Secure digging cable to cable drum as shown in figure 2-10.

(8) Raise gantry mast to working position using boom hoist lever. Spool the slack hoist cable on boom hoist drum slowly, making certain cable wraps evenly on drum the first time.

(9) Unroll and stretch hoist cable out on ground on right side of boom.

(10) Reeve hoist cable as shown in figure 2-21.

(11) Extend dipper out as far as it will go with dipper on the ground. Secure hoist line to cable drum as shown in figure 2-10.

d. Adjust Backhoe Pitch Braces.

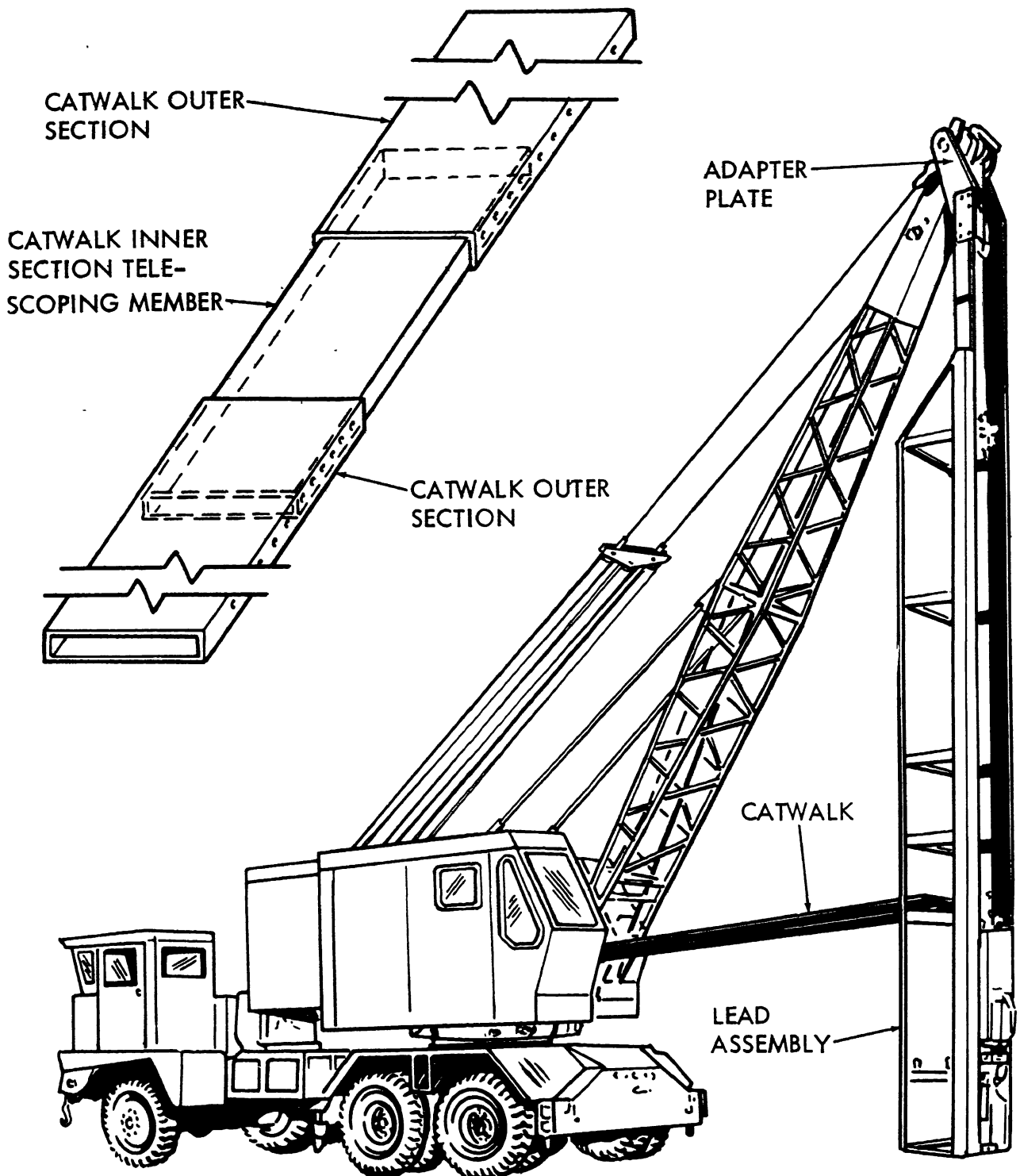
NOTE

The backhoe pitch braces (fig. 2-18) contain four holes in each brace for adjustment.

(1) Position backhoe boom over rear of carrier and extend dipper handle until dipper teeth are in vertical position. Lower dipper to ground and remove nut and threaded pin which secure braces to dipper handle. To shorten braces, move carrier backward slowly until holes in braces are aligned with holes in dipper handle. To lengthen braces, move the carrier forward. After the holes have been aligned, install the threaded pin and nut.

e. Unreeving Backhoe Digging Cable.

(1) Pull dipper in under boom and lower it to ground.

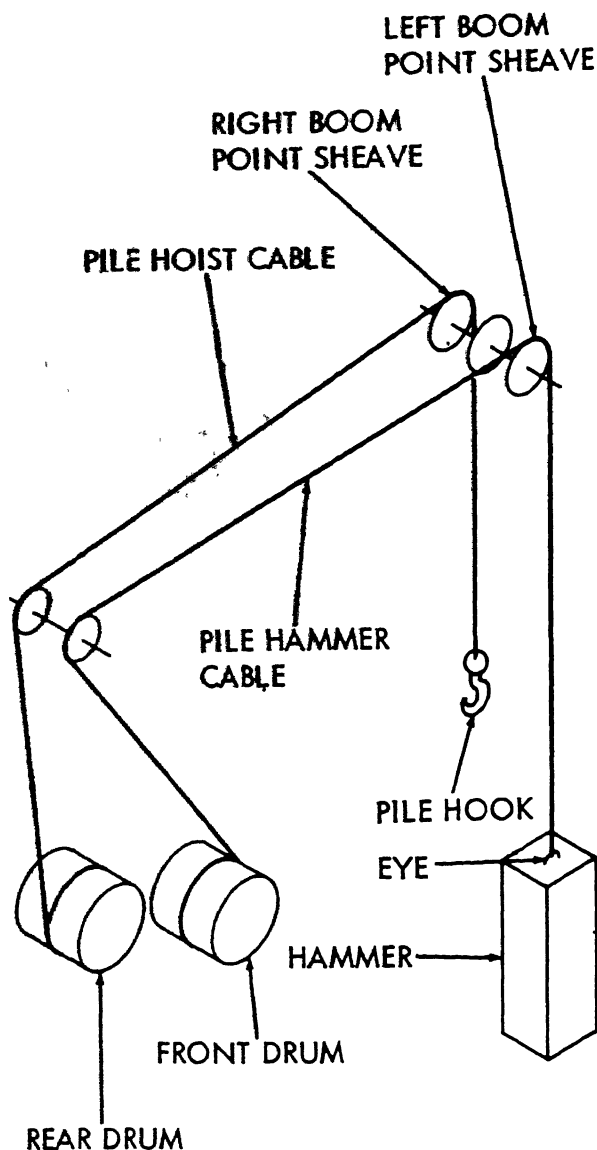


ME 3810-294-20/2-16

Figure 2-16. Piledriver lead and adapter installation.

(2) Release front cable drum brake and spool cable off drum. Remove cable wedge from drum socket and pull cable free of drum and cable guide sheave on boom.

(3) Remove wedge from dead-end socket on boom and pull cable free of padlock, guide sheave, and boom.



ME 3810-294-20/2-17

Figure 2-17. Piledriver reeving diagram.

- (4) Lay cable out straight on ground.
- (5) Roll cable into coil and secure with wire. Label cable for future use.

f. Unreeving Backhoe Hoist Cable.

- (1) Release rear cable drum brake and spool cable from rear cable drum. Remove cable wedge and pull cable free of drum.
- (2) Remove cable wedge from dead-end socket on hoist padlock sheave and pull cable free of all sheaves.
- (3) Lay cable out straight on ground.
- (4) Roll cable into coil and secure with wire. Label cable for future use.

g. Unreeving Backhoe Mast Suspension Cable.

- (1) Pull dipper in under boom and lower it to ground.
- (2) Slack off on mast suspension cable and lower mast forward to rest on boom.
- (3) Spool cable off boom hoist drum and remove cable wedge from drum socket.
- (4) Remove wedge from dead-end socket on gantry A-frame.
- (5) Pull cable free of all sheaves and the mast.
- (6) Roll cable into coil and secure with wire. Label cable for future use.

h. Removing Backhoe Boom.

- (1) Raise boom and dipper off ground. Pull dipper in under boom and lower dipper onto wood blocks (fig. 2-18). Crib base of boom as shown in figure 2-18.
- (2) Remove all cables. Refer to figures 2-19, 2-20, and 2-21.
- (3) Use wedge between cribbing and boom to remove weight of boom from boom foot pins.
- (4) Remove boom foot pins. Drive boom foot pins out of boom foot lugs, releasing backhoe boom attachment from crane revolving frame.
- (5) Drive carrier slowly away from backhoe attachment.

CAUTION

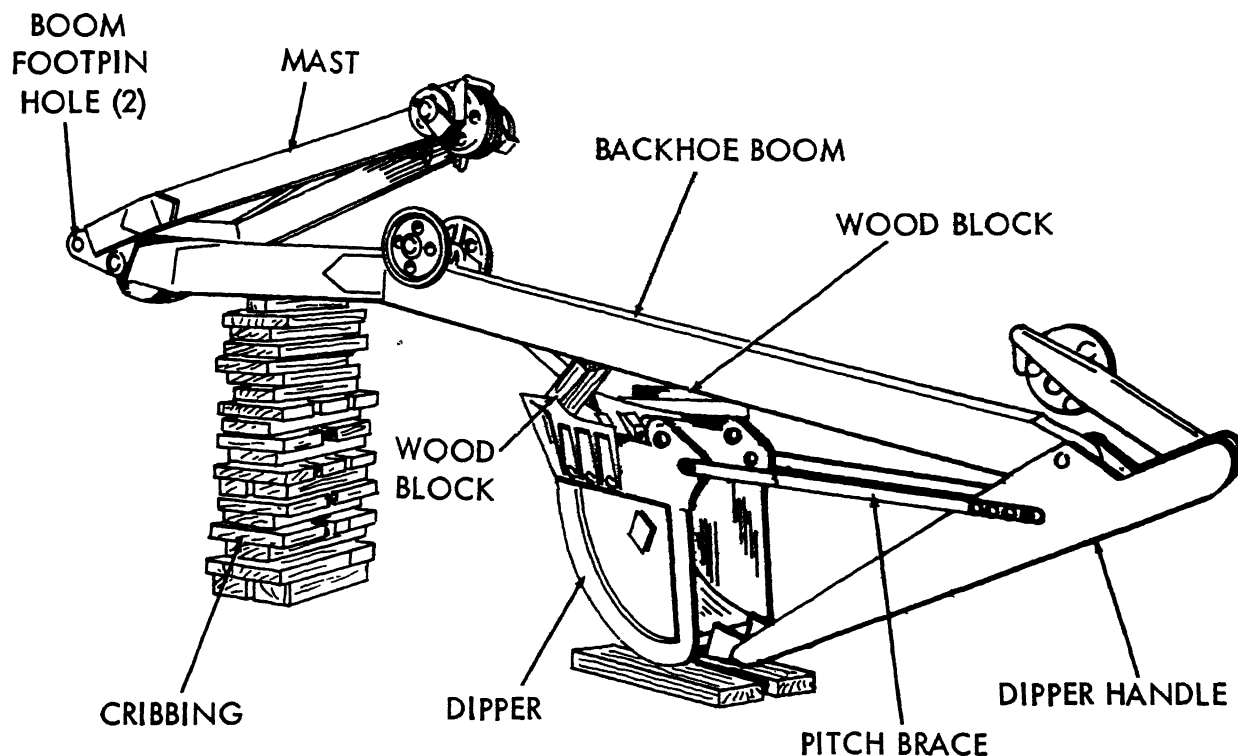
Use care when swinging the revolving frame without a boom since it will tend to be unbalanced toward the counterweight end.

2-9. Shovel Conversion

a. General. The crane may be converted to shovel operation by installing the shovel attachment. The following components are necessary for the equipment conversion: shovel boom saddle block, dipper stick, dipper, boom foot roller assembly, crowd chain tightener and crowd chain, special shovel front and rear drum laggings which are illustrated in figure 2-22.

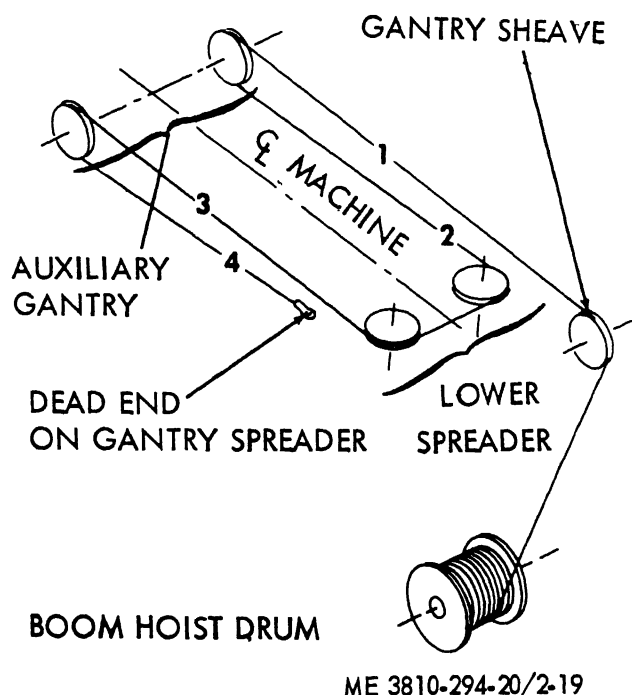
b. Installation.

- (1) Install crowd sprocket lagging on front drum as instructed in figure 2-23.
- (2) Install the split rear drum lagging on rear drum as shown on figure 2-22.
- (3) Install crowd chain tightener as instructed on figure 2-24.
- (4) With shovel boom cribbed to height of revolving frame boom foot lug holes (fig. 2-25), back crane to the boom and align boom



ME 3810-294-20/2-18

Figure 2-18. Cribbing prepared for backhoe boom assembly, installation and removal.



ME 3810-294-20/2-19

Figure 2-19. Backhoe auxiliary gantry suspension reeving.

foot pin holes in boom with those in revolving
frame.

(5) Install boom foot pin through left boom foot lug. Using a suitable lifting device, support boom foot drum in position and install boom foot pin through drum and right boom foot lug. Install boom foot pin retaining plates, capscrews, lockwashers, and nuts (fig. 2-26). Connect electrical line to dipper trip motor.

(6) Install crowd chain around front drum sprocket, boom foot drum sprocket, and over the chain tightener. Adjust chain (TM 5-3810-294-10).

c. *Reeving Crowd Cable.*

(1) Unroll and stretch crowd cable out on ground on right side of boom.

(2) Reeve one end of crowd cable under and around the bottom foot drum to right cable socket on drum and secure cable to drum as shown in figure 2-10.

(3) Reeve other end of crowd cable around front of right groove in shipper shaft roller, around dipper stick rope thimble, around front of left groove in shipper shaft roller, under and around boom foot drum to left cable socket on drum and secure cable to drum (fig. 2-27).

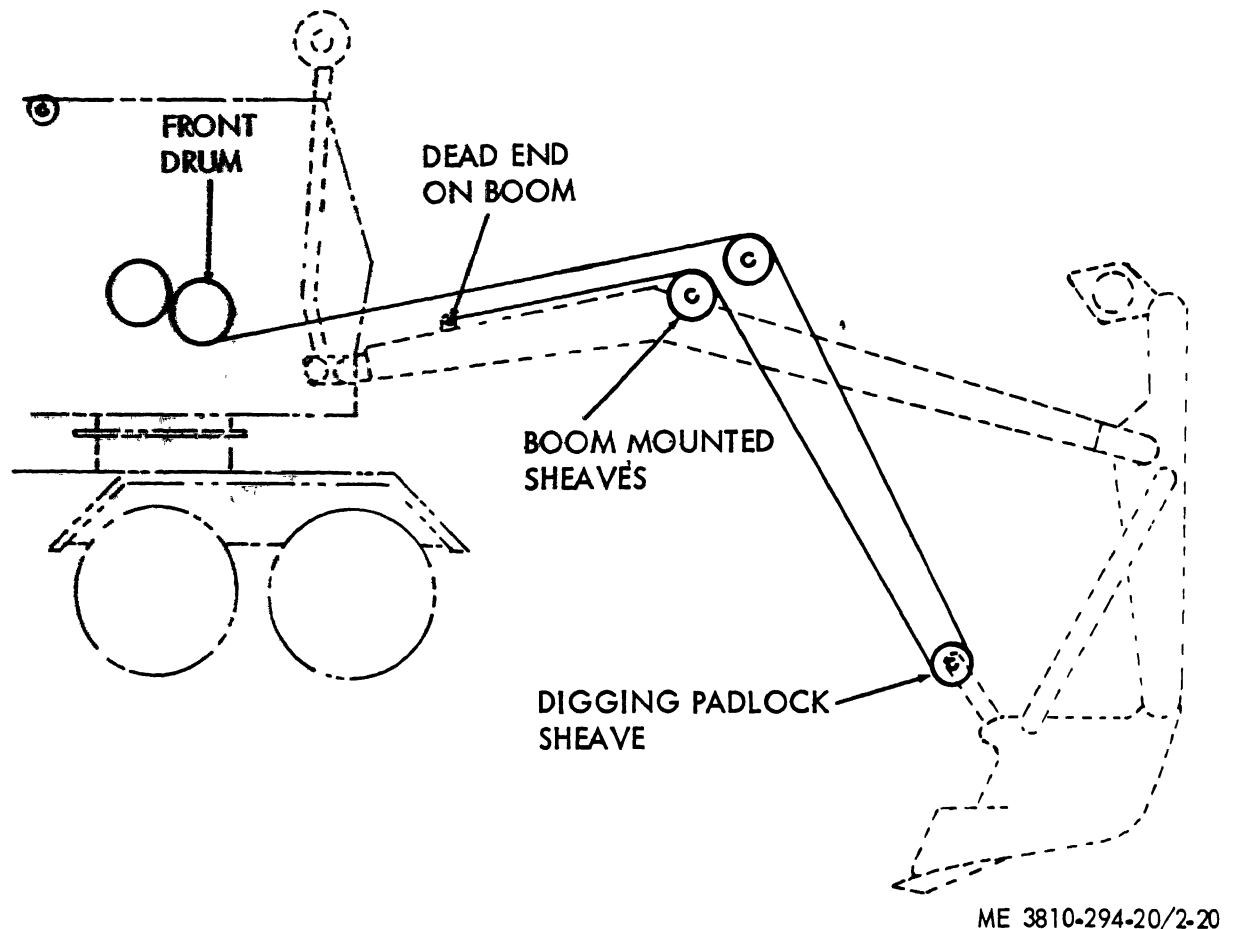


Figure 2-20. Backhoe digging cable reeving.

d. Retract Cable Reeving.

(1) Unroll and stretch retract cable out on ground on right side of boom.

(2) Secure one end of cable to dipper stick (fig. 2-27). Reeve other end of cable over top of center groove in shipper shaft roller and over and around boom foot drum. Wrap excess length around drum and secure the end to drum.

e. Reeving Shovel Dipper Hoist Cable.

(1) Unroll and stretch dipper hoist cable out on right side of boom.

(2) Reeve one end of cable up and over left boom point sheave, down the top side of boom, and over the left cable drum.

(3) Insert end of cable through cable dead-end socket, loop it and insert end of cable back into socket, taking care that end does not protrude all the way through. Insert cable wedge into socket and pull cable tight around it.

(4) Reeve remaining free end of cable around padlock sheave on shovel, dipper, up and

over the right boom point sheave, and to the cable socket on boom (fig. 2-28).

f. Reeving Shovel Boom Hoist Cable.

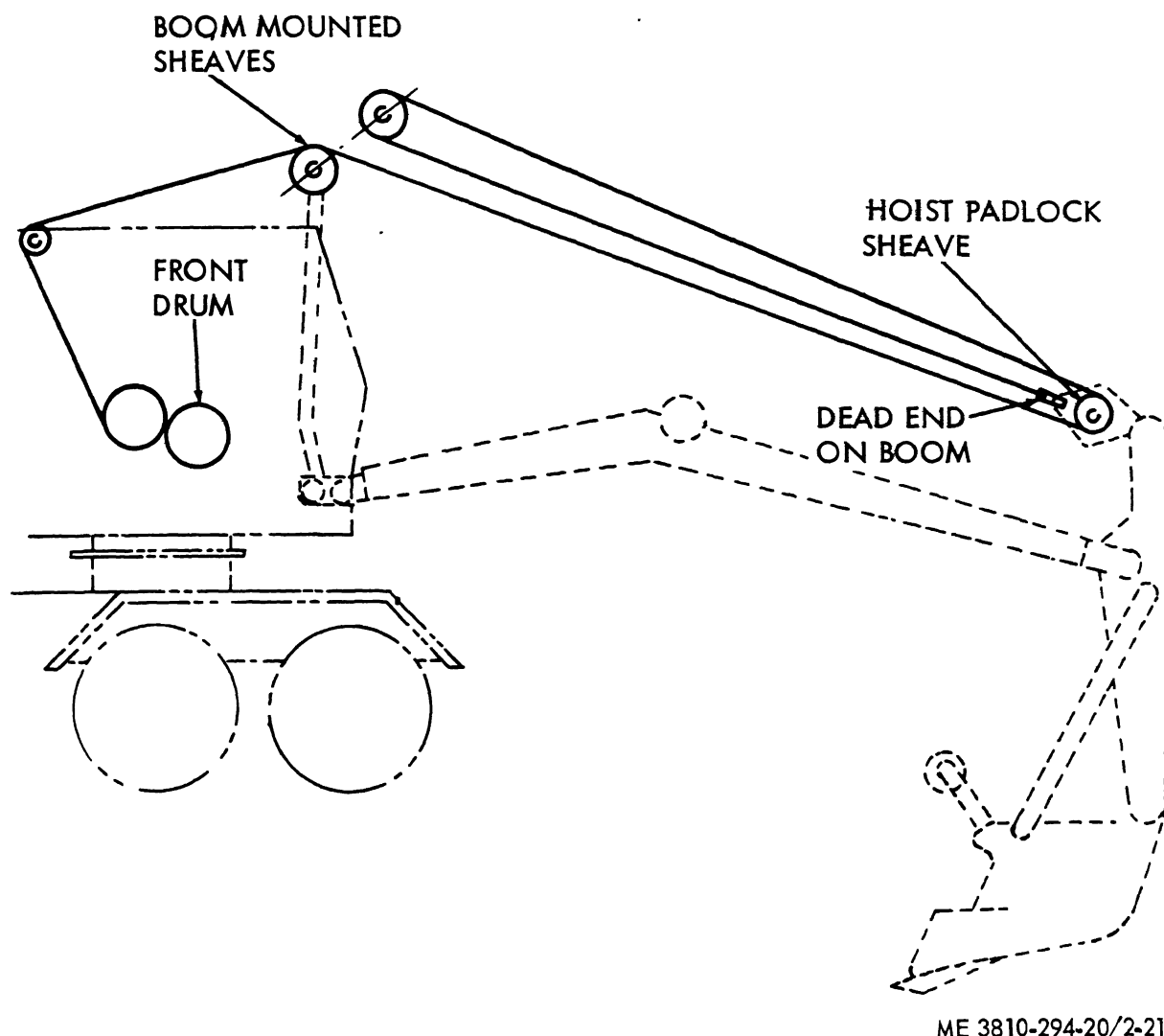
(1) Unroll and stretch boom hoist cable out on ground on right side of boom.

(2) Reeve one end of cable around lower left gantry spreader sheave, around inside of left boom point sheave, around upper gantry spreader sheave, around outside left boom point sheave, and back to dead-end on gantry spreader (fig. 2-29).

(3) Reeve other end of boom hoist cable around lower right gantry spreader sheave around inside right boom point sheave, around upper right gantry spreader sheave, around outside right boom point sheave, and down to boom hoist drum.

(4) Secure boom hoist line to boom hoist drum as shown in figure 2-10.

(5) Spool the slack cable on drum.



ME 3810-294-20/2-21

Figure 2-21. Backhoe hoist cable reeving.

g. Reeving Shovel Dipper Trip Cable.

(1) Raise dipper off ground and crowd it out as far as it will go; then lower it to the ground.

(2) Unroll and stretch dipper trip cable out on ground on right side of boom.

(3) Reeve cable from trip lever on dipper stick, over small sheaves on shipper shaft, round dipper trip motor eccentric, around outside sheave on shipper shaft, and back to dead end on dipper stick (fig. 2-30).

h. Adjustments. Refer to TM 5-3810-294-10.

NOTE

Each adjustment must be made or checked before a machine converted to shovel operation is placed in service.

i. Unreeving Shovel Cables.

(1) To unreeve shovel dipper trip cable, remove cable clamp at dipper trip lever and dead end on dipper stick. Pull cable from drum and sheaves. Coil cable neatly and secure with wire. Label cable for future use.

(2) To unreeve boom hoist cable, hoist dipper up and crowd it out beyond boom point sheaves. Lower boom onto blocking (fig. 2-25). Unspool cable from drum. Remove cable wedge from cable drum socket and free cable. Pull cable free of drum and boom point sheaves and lay it out straight on ground. Roll cable into coil and secure with wire. Label cable for future use.

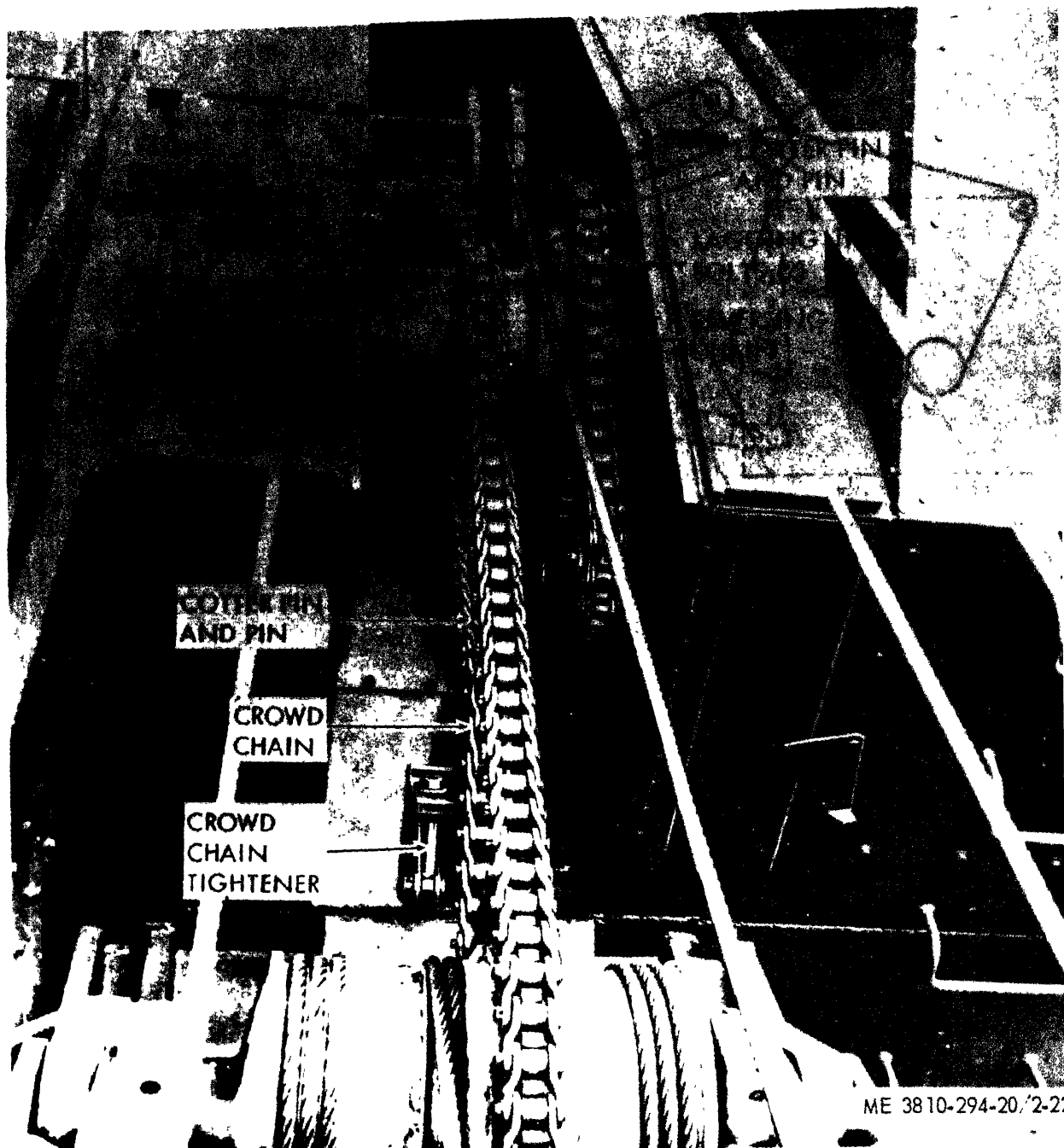


Figure 2-22. Shovel drum laggings.

j. Removing Shovel.

(1) Prepare cribbing (fig. 25) under base of boom. Unreeve hoist cable as described in *i* above.

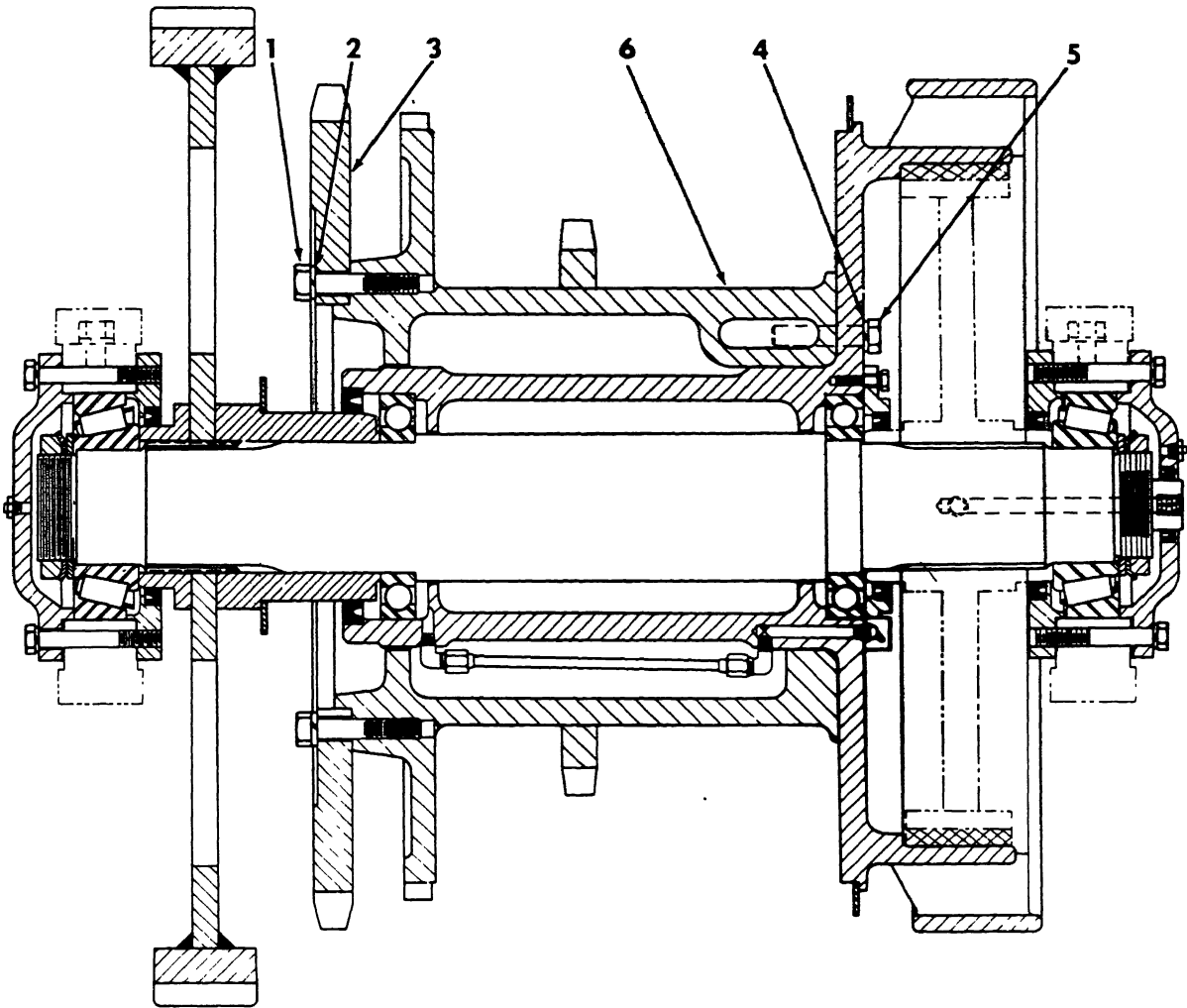
(2) Remove crowd chain by removing cotter pin, pin, and connecting link. Lubricate with OE, label, and store the chain.

(3) Disconnect the electrical line to dipper trip motor.

(4) Remove capscrews, lockwashers, a retaining plates at boom foot pins; remove boom foot pins and boom foot drum from revolving frame.

(5) Drive carrier clear of shovel boom assembly.

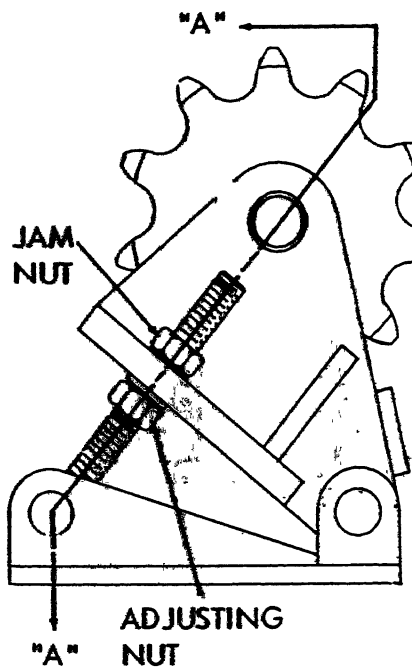
(6) Remove front drum sprocket lagging. Coat sprocket lagging and boom foot drum sprocket with oil to prevent rust.



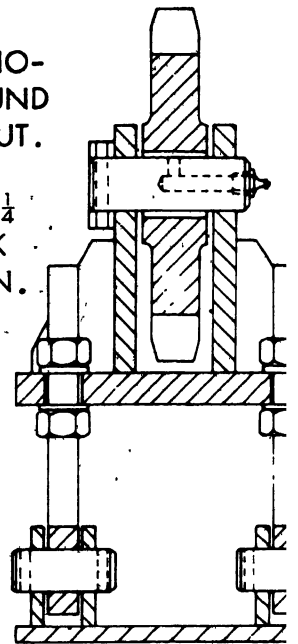
- STEP 1. REFER TO PARAGRAPH 2-4 AND UNREEVE THE CABLES FROM FRONT AND REAR DRUMS. REFER TO FIGURE 2-23 AND REMOVE COTTER PIN, PIN AND REVERSING CHAIN.
- STEP 2. REMOVE CAPSCREWS (5) AND LOCKWASHERS (4). REFER TO FIGURE 2-22 AND REMOVE LAGGING BOLTS.
- STEP 3. REMOVE ROPE LAGGING FROM THE FRONT DRUM, AND REMOVE REVERSING SPROCKET HALVES (3) FROM THE LAGGING HALVES BY REMOVING CAPSCREWS (1) AND LOCKWASHERS (2).
- STEP 4. INSTALL REVERSING SPROCKET HALVES (3) ON CROWD SPROCKET LAGGING HALVES AND INSTALL THE CROWD SPROCKET LAGGING ON THE FRONT DRUM. INSTALL CAPSCREWS (5) AND LOCKWASHERS (4).

ME 3810-294-20/2-23

Figure 2-23. Installing crowd sprocket lagging.



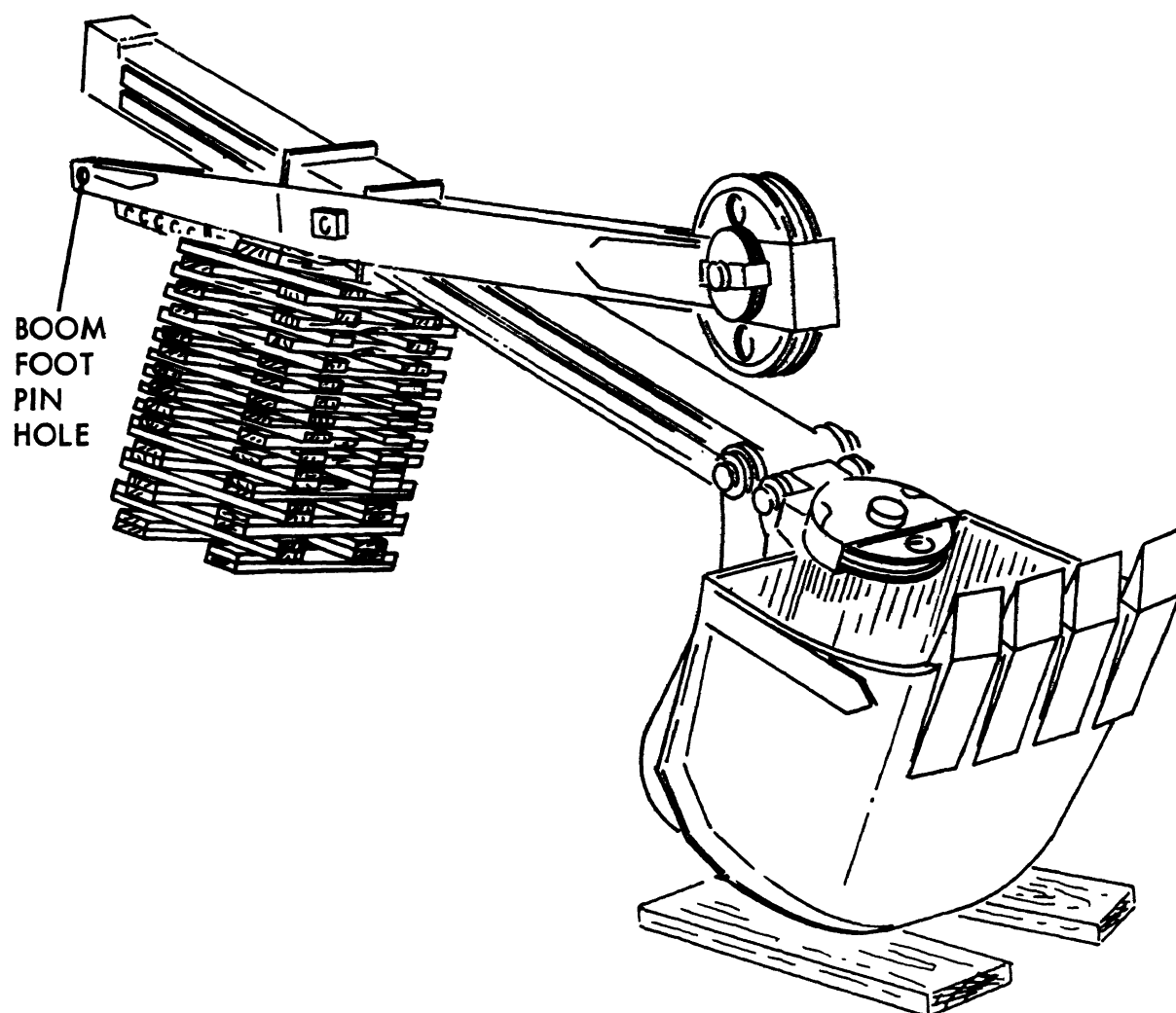
- STEP 1. PIN IN PLACE AS SHOWN ON FIGURE 2-22.
- STEP 2. TO ADJUST, PLACE SHOVEL FRONT ON GROUND AND LOOSEN JAM NUT.
- STEP 3. TIGHTEN ADJUSTING NUT UNTIL THERE IS $1\frac{1}{4}$ INCH MIDSPAN SLACK AT BOTTOM OF CHAIN.
- STEP 4. TIGHTEN JAM NUT.



SECTION "A"-"A"

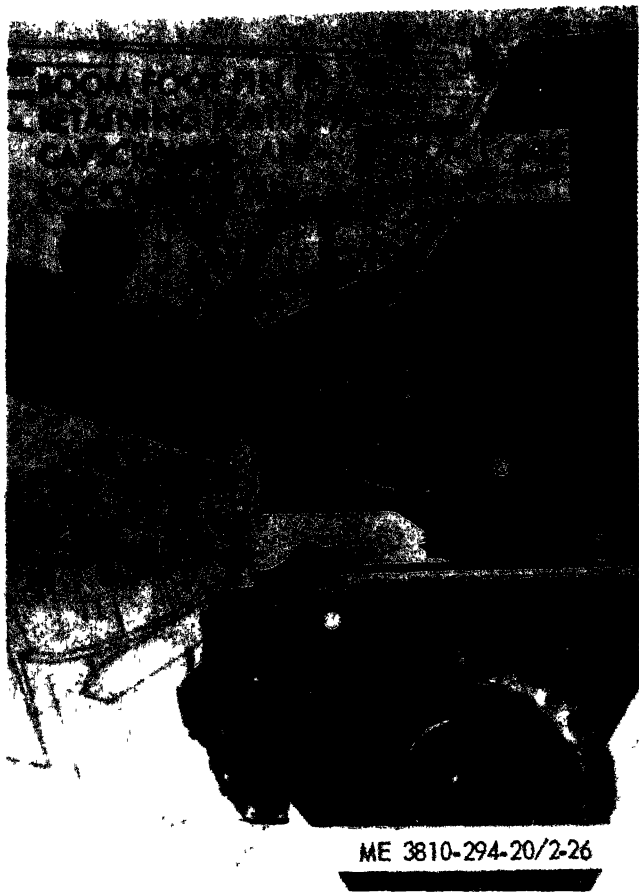
ME 3810-294-20/

Figure 2-24. Crow chain tightener.



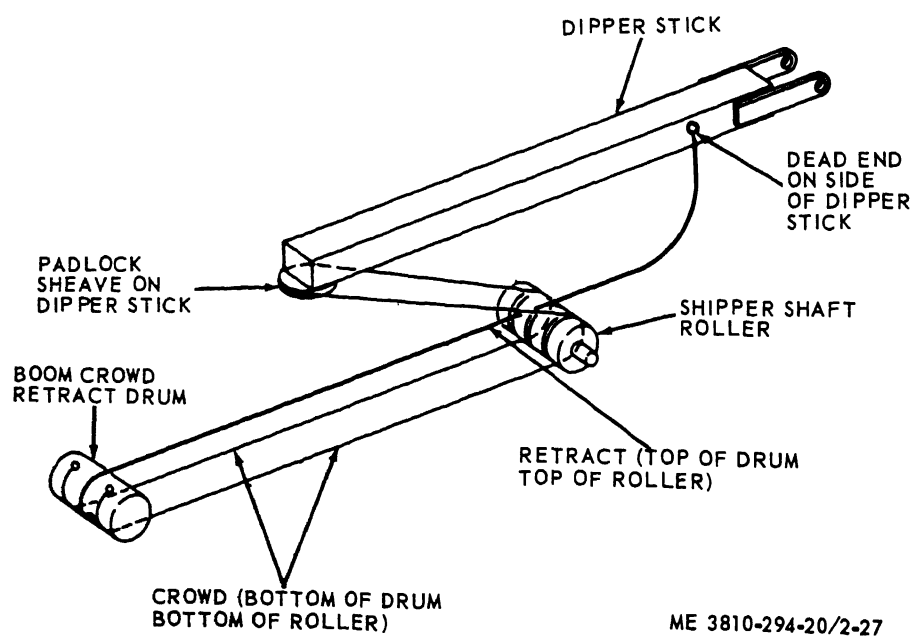
ME 3810-294-20/2-25

Figure 2-25. Cribbing shovel boom assembly.



ME 3810-294-20/2-26

Figure 2-26. Shovel boom installation.



ME 3810-294-20/2-27

Figure 2-27. Crowd and retract cable reeving.

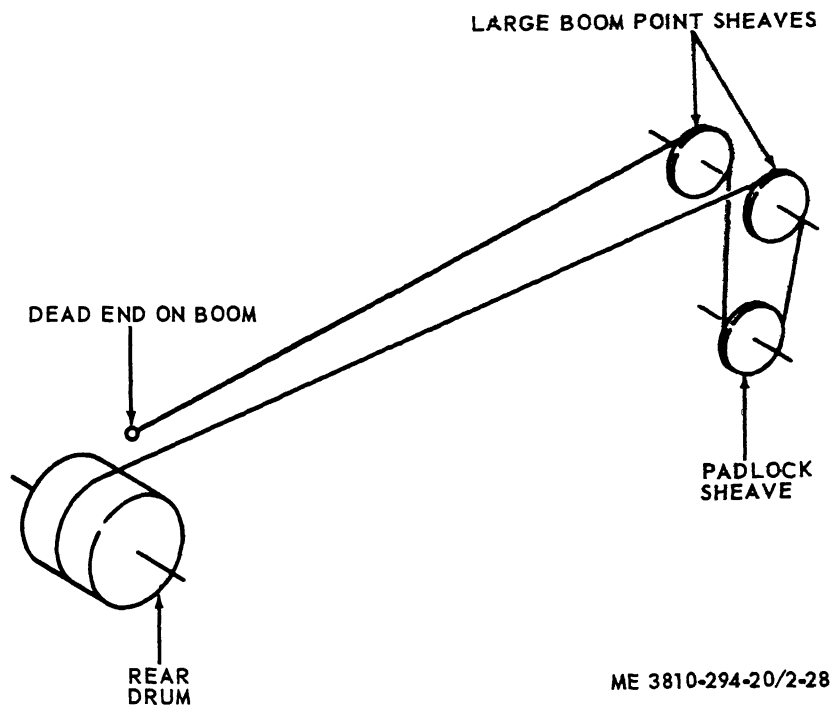


Figure 2-28. Dipper hoist cable reeving.

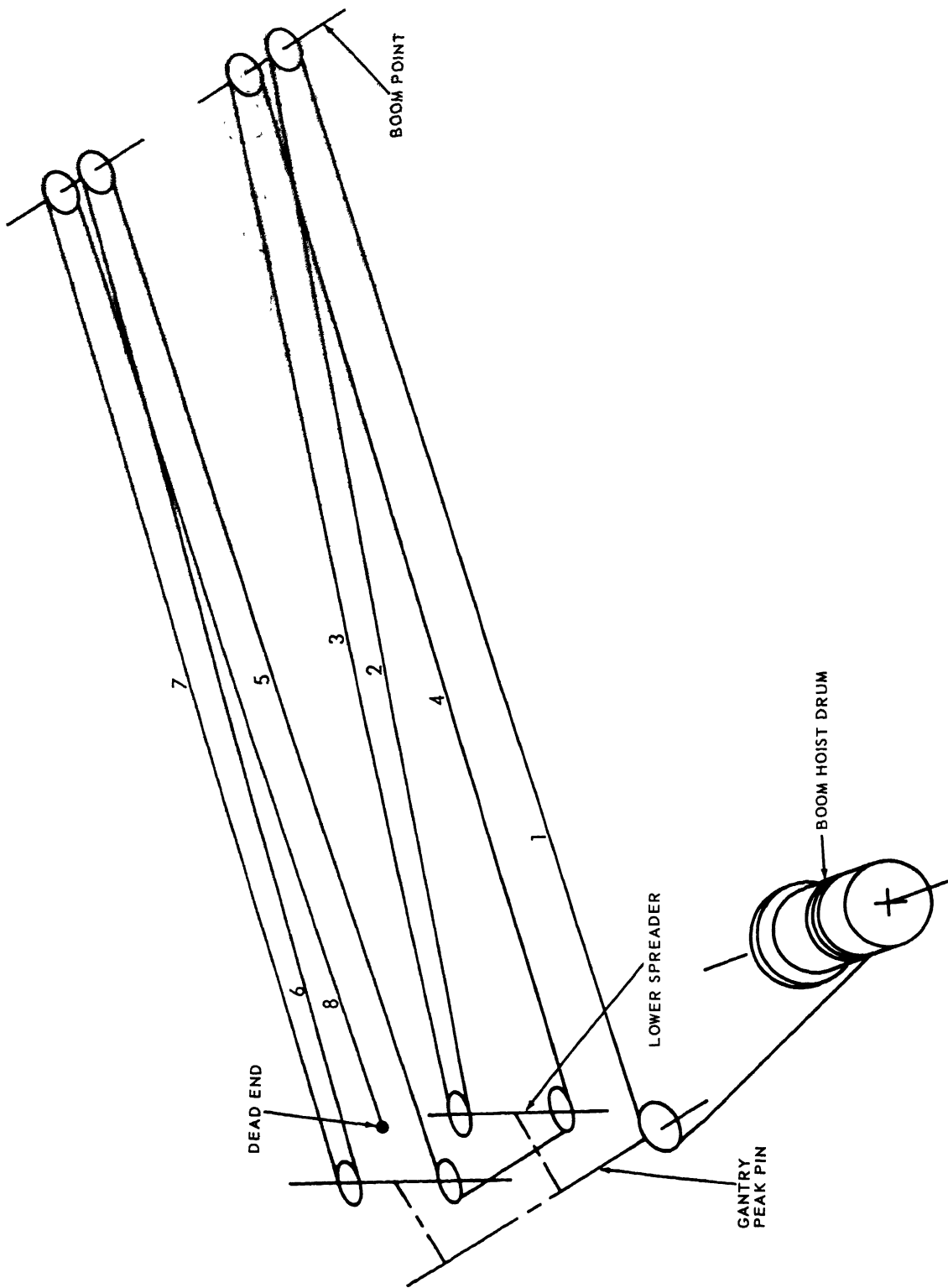
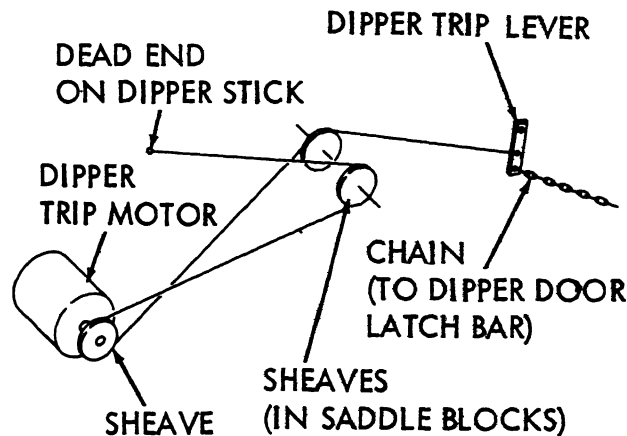


Figure 2-29. Boom hoist cable reeving.



ME 3810-294-20/2-30

Figure 2-30. Dipper trip cable reeving.

Section II. MOVEMENT TO A NEW WORKSITE

2-10. Dismantling for Movement

a. The crane can be transported readily as it is mounted on its own carrier. Instructions for transportation of crane with front end equipment attached are contained in TM 5-3810-294-10.

WARNING

Do not transport crane with the piledriver front-end installed.

b. When it is necessary to remove the front end equipment for movement to a new worksite, refer to the appropriate instructions (para 2-4 through 2-9).

2-11. Reinstallation after Movement

a. Refer to the appropriate instructions (para 2-4 through 2-9) to install front end equipment.

b. Refer to TM 5-3810-294-10 for installation or setting-up instructions.

Section III. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

2-12. Tools and Equipment

Tools, equipment, and repair parts issued with or authorized for the crane are listed in the basic issue items troop installed or authorized list. Refer to TM 5-3810-294-10.

2-13. Special Tools and Equipment

No special tools or equipment are required for

organizational level maintenance of the crane (revolving frame).

2-14. Maintenance Repair Parts

Repair parts and equipment are listed and illustrated in the repair parts and special tools list covering organizational maintenance for this equipment (TM 5-3810-294-20P).

Section IV. LUBRICATION INSTRUCTIONS

2-15. General

General lubrication instructions are listed in TM 5-3810-294-10.

2-16. Detailed Lubrication Instructions

Refer to Lubrication Order (LO 5-3810-294-12).

Section V. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

2-17. General

To insure that the crane is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The preventive maintenance checks and services to be performed are listed and described in paragraph 2-18. The sequence numbers indicate the sequence of minimum inspection requirements. Defects discovered during operation of the unit will be noted for future correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noted during operation which would damage the equipment if operation were continued. All deficiencies and

shortcomings will be recorded together with the corrective action taken on DA Form 2404 at the earliest possible opportunity.

2-18. Preventive Maintenance Checks and Services

a. Table 2-1 contains a tabulated list of preventive maintenance checks and services which must be performed by organizational maintenance personnel.

b. The interval and sequence columns designate the required service interval. A quarterly interval is equal to 3 calendar months or 25 hours of operation, whichever occurs first.

Table 2-1. Preventive Checks and Services

M — Monthly Total man-hours required: 1.5		Q — Quarterly Total man-hours required: 26.4	
Interval and Sequence No.		Item to be Inspected Procedure	Work Time (M/H)
M	Q		
1		BELTS Adjust as required. Replace worn, frayed, or cracked belts (fig. 2-85).	.5
2		BOOM HOIST BRAKE Check operation; adjust as necessary (fig. 2-112).	.5
3		ENGINE OIL Inspect and service (para 2-96).	.5
4		FUEL TANK, LINES, AND FITTINGS Keep tank full. Inspect lines and fittings for leaks. Tighten loose fittings. Replace damaged lines or fittings (para 2-79).	.5
5		RADIATOR Tighten mounting clamps and connections, if necessary, making sure no leaks are apparent. The correct cap pressure rating is 4 psi. Replace cracked or damaged hose. Replace a leaking or faulty radiator (para 2-74).	1.0
6		BATTERIES Check electrolyte level and specific gravity (1.285-1.300) using hydrometer; and check tightness of connections. Fill to 3/8-inch above the plates. In freezing weather, run engine for one hour after adding water. Clean vent hole in filler caps before installing (para 2-53).	.2
7		ENGINE OIL FILTERS Change filter elements. Replace filter cover gaskets, if necessary. Check for leaks, and repair if necessary (para 2-98).	1.0
8		HYDRAULIC FLUID RESERVOIR Check level and add fluid if necessary (para 2-72).	.2
9		FRONT DRUM CLUTCH Check operation; adjust if necessary. Check lining thickness; if lining is worn to within 1/16-inch of rivet heads at point of most wear, install new lining (para 2-106).	2.5

Table 2-1. Preventive Maintenance Checks and Services—Continued

M — Monthly Total man-hours required: 1.5		Q — Quarterly Total man-hours required: 26.4	
Interval and Sequence No.		Item to be Inspected Procedure	Work Time (M/H)
M	Q		
	10	REAR DRUM CLUTCH Check operation; adjust if necessary. If lining is worn to within 1/16-inch of rivet heads at point of most wear, install new lining (para 2-105).	2.5
	11	BOOM HOIST CLUTCH Check operation: adjust if necessary. If lining is worn to within 1/16-inch of rivet heads at point of most wear, install new lining (para 2-108).	2.5
	12	FRONT DRUM BRAKE Check operation; adjust if necessary. If lining is worn to within 1/16-inch of rivet heads at point of most wear, install new lining (para 2-106).	2.5
	13	REAR DRUM BRAKE Check operation; adjust if necessary. If lining is worn to within 1/16-inch of rivet heads at point of most wear, install new lining (para 2-105).	2.5
	14	BOOM AND/OR JIB Inspect visually for damage including cracks, breaks, and general condition. Replace damaged boom or jib sections (para 2-37).	2.0
	15	ENGINE CLUTCH Inspect, and adjust if necessary (para 2-101).	.5
	16	HOOK ROLLERS Inspect hook rollers for wear and proper adjustment. Maximum allowable clearance between hook rollers and lower side of roller path is 1/16-inch. Replace severely worn rollers (para 2-111).	3.0
	17	OPERATOR'S CAB Replace cracked glass or damaged door (para 2-62 and 2-61).	1.0
	18	LIGHTS Inspect lights for loose cables, mountings, cracked lens, and proper operation. Repair or replace defective lamps or bulbs (para 2-51).	1.5
	19	REAR DRUM DRIVE CHAIN, REVERSING CHAIN, SHOVEL CROWD CHAIN, AND HORIZONTAL SWING SHAFT CHAIN Inspect for wear. Replace chain if worn excessively (para 2-110).	1.0
	20	GANTRY Inspect for cracks, worn sheaves, and improper lubrication (para 2-65).	2.0

Section VI. TROUBLESHOOTING

2-19. General

a. This section contains troubleshooting information for locating and correcting trouble which may develop in the crane (revolving frame) that are within the scope of organizational maintenance. Each malfunction for an individual component, unit, or system is followed by a list of tests or inspections which will help you to determine probable causes of trouble and corrective actions to take. You should perform the tests/

inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

2-20. Troubleshooting

Refer to table 2-2.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. ENGINE WILL NOT CRANK		
	Step 1. Test batteries.	Replace defective batteries (para 2-53).
	Step 2. Check starter relay.	Replace defective relay (2-89).
2. ENGINE CRANKS BUT WILL NOT START		
	Step 1. Check for open primary ignition circuit.	Tighten primary lead at distributor (para 2-91). Clean dirty ignition points; replace defective points (para 2-90). Repair open ignition switch circuit (para 2-50).
	Step 2. Check for grounded primary ignition circuit.	If insulator on primary lead is cracked, replace lead (para 2-92). Adjust ignition points (para 2-90). Replace defective capacitor (fig. 2-3)
	Step 3. Check for faulty secondary ignition circuit.	Clean spark plug cable terminals. If cable insulation is broken or cracked, replace cable (para 2-92). Clean dirty spark plugs; replace damaged spark plugs (para 2-91). If distributor cap is cracked, replace cap (para 2-90). If rotor is cracked or rotor contact arm broken, replace rotor.
	Step 4. Test batteries.	Replace defective batteries (para 2-53).
	Step 5. Check for improper valve tappet clearance.	Adjust valves (para 2-97).
	Step 6. Check fuel pump.	Replace faulty fuel pump (para 2-84).
	Step 7. Check carburetor adjustment.	Adjust carburetor (para 2-83.)
3. ENGINE MISFIRES		
	Step 1. Check spark plugs for fouled plug or cracked porcelain.	Clean or replace plugs (para 2-91).
	Step 2. Check for burned or pitted ignition points.	Replace points (para 2-90).
	Step 3. Check for incorrect ignition point gap.	Adjust points (para 2-90).
4. ENGINE IDLES ROUGH		
	Step 1. Check carburetor adjustment.	Adjust carburetor (para 2-83).
	Step 2. Check ignition point gap for gap too narrow or much too wide.	Adjust points (para 2-90).
	Step 3. Check for improper valve tappet clearance.	Adjust valves (para 2-97).
5. ENGINE FAILS TO REACH OPERATING TEMPERATURE		
	Step 1. Check for thermostat stuck open or removed from engine.	Replace defective thermostat (para 2-85).
	Step 2. Check for defective temperature sending unit or engine control panel gage.	Replace defective unit (para 2-93).
6. ENGINE OVERHEATS		
	Step 1. Check for loose water pump V-belt.	Adjust V-belt (fig. 2-85).
	Step 2. Check for faulty water pump.	Replace defective water pump (para 2-86).
	Step 3. Check for collapsed or clogged hoses.	Replace hoses (para 2-85).
	Step 4. Check for defective thermostat.	Replace thermostat (para 2-85).
	Step 5. Check for clogged or leaky radiator.	Replace radiator (para 2-74).
	Step 6. Check for engine oil leaks at filter or at any external piping.	Replace leaky oil filter or piping (para 2-98).
7. LOW OIL PRESSURE		
	Step 1. Check for loose connections in oil lines.	Tighten connections (para 2-98).

Table 2-2. Troubleshooting—Continued

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
Step 2.	Check for clogged oil filter. Replace oil filter (para 2-98).
Step 3.	Check for oil too thin due to dilution or too light a grade used. Drain crankcase and refill with proper oil (para 2-86).
8. HIGH OIL PRESSURE	
Step 1.	Oil too heavy. Drain crankcase and refill with proper oil (para 2-96).
Step 2.	Check for defective oil pressure gage on engine control panel. Replace oil pressure gage (para 2-54).
9. EXCESSIVE OIL CONSUMPTION	
Step 1.	Check oil lines for leaks at connections. Tighten loose connections (para 2-98).
Step 2.	Check for poor quality or wrong grade of oil. Drain crankcase and refill with proper oil (para 2-96).
10. ENGINE LACKS POWER	
Step 1.	Fuel pump not operating properly. Refer to paragraph 2-84 and test fuel pump. Replace defective pump.
Step 2.	Check for dirty or faulty carburetor. Clean or replace carburetor (para 2-83).
Step 3.	Check for faulty spark plugs. Replace plugs (para 2-91).
Step 4.	Check for burned, pitted, or sticking ignition points. Replace points (para 2-90).
11. BATTERIES DISCHARGE WITH ENGINE RUNNING	
	Check for loose alternator V-belt or faulty alternator. Adjust V-belt tension or replace faulty alternator. (para 2-88).
12. LIGHTS FAIL	
Step 1.	Check for defective or burned out lamps. Replace lamps (para 2-51).
Step 2.	Check for defective wiring. Repair or replace wiring (para 2-50).
Step 3.	Check for defective switch. Replace switch (para 2-55).
Step 4.	Check for faulty ground. Clean ground terminals
13. REVOLVING FRAME TEETERS	
	Check hook rollers for improper adjustment. Adjust hook rollers (para 2-111).
14. HEATER MOTOR INOPERATIVE	
Step 1.	Check wiring. Replace faulty wiring (para 2-68).
Step 2.	Check heater blower motor. Replace defective motor.
15. HEATER DELIVERS COLD AIR	
Step 1.	Check for stuck thermostat. Replace defective thermostat.
Step 2.	Check for blocked heater hose. Repair or replace hose.
Step 3.	Check for air lock in water line to heater. Disconnect heater hose and drain line until air block is bled from system.
Step 4.	Check for dirt on outside of coil. Remove cover and clean outside of coil.
Step 5.	Check for sediment in inside of coil. Remove input and output hoses and flush coil with suitable solvent.
16. HEATER DOES NOT DELIVER AIR	
Step 1.	Check for inoperative heater motor. Refer to malfunction 14 above.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. ENGINE WILL NOT CRANK		
	Step 1. Test batteries.	Replace defective batteries (para 2-53).
	Step 2. Check starter relay.	Replace defective relay (2-89).
2. ENGINE CRANKS BUT WILL NOT START		
	Step 1. Check for open primary ignition circuit.	Tighten primary lead at distributor (para 2-91). Clean dirty ignition points; replace defective points (para 2-90). Repair open ignition switch circuit (para 2-50).
	Step 2. Check for grounded primary ignition circuit.	If insulator on primary lead is cracked, replace lead (para 2-92). Adjust ignition points (para 2-90). Replace defective capacitor (fig. 2-i)
	Step 3. Check for faulty secondary ignition circuit.	Clean spark plug cable terminals. If cable insulation is broken or cracked, replace cable (para 2-92). Clean dirty spark plugs; replace damaged spark plugs (para 2-91). If distributor cap is cracked, replace cap (para 2-90). If rotor is cracked or rotor contact arm broken, replace rotor.
	Step 4. Test batteries.	Replace defective batteries (para 2-53).
	Step 5. Check for improper valve tappet clearance.	Adjust valves (para 2-97).
	Step 6. Check fuel pump.	Replace faulty fuel pump (para 2-84).
	Step 7. Check carburetor adjustment.	Adjust carburetor (para 2-83.)
3. ENGINE MISFIRES		
	Step 1. Check spark plugs for fouled plug or cracked porcelain.	Clean or replace plugs (para 2-91).
	Step 2. Check for burned or pitted ignition points.	Replace points (para 2-90).
	Step 3. Check for incorrect ignition point gap.	Adjust points (para 2-90).
4. ENGINE IDLES ROUGH		
	Step 1. Check carburetor adjustment.	Adjust carburetor (para 2-83).
	Step 2. Check ignition point gap for gap too narrow or much too wide.	Adjust points (para 2-90).
	Step 3. Check for improper valve tappet clearance.	Adjust valves (para 2-97).
5. ENGINE FAILS TO REACH OPERATING TEMPERATURE		
	Step 1. Check for thermostat stuck open or removed from engine.	Replace defective thermostat (para 2-85).
	Step 2. Check for defective temperature sending unit or engine control panel gage.	Replace defective unit (para 2-93).
6. ENGINE OVERHEATS		
	Step 1. Check for loose water pump V-belt.	Adjust V-belt (fig. 2-85).
	Step 2. Check for faulty water pump.	Replace defective water pump (para 2-86).
	Step 3. Check for collapsed or clogged hoses.	Replace hoses (para 2-85).
	Step 4. Check for defective thermostat.	Replace thermostat (para 2-85).
	Step 5. Check for clogged or leaky radiator.	Replace radiator (para 2-74).
	Step 6. Check for engine oil leaks at filter or at any external piping.	Replace leaky oil filter or piping (para 2-98).
7. LOW OIL PRESSURE		
	Step 1. Check for loose connections in oil lines.	Tighten connections (para 2-98).

Table 2-2. Troubleshooting—Continued

ALFUNCTION TEST OR	INSPECTION CORRECTIVE ACTION
Step 2.	Check for clogged oil filter. Replace oil filter (para 2-98).
Step 3.	Check for oil too thin due to dilution or too light a grade used. Drain crankcase and refill with proper oil (para 2-86).
HIGH OIL PRESSURE	
Step 1.	Oil too heavy. Drain crankcase and refill with proper oil (para 2-96).
Step 2.	Check for defective oil pressure gage on engine control panel. Replace oil pressure gage (para 2-54).
EXCESSIVE OIL CONSUMPTION	
Step 1.	Check oil lines for leaks at connections. Tighten loose connections (para 2-98).
Step 2.	Check for poor quality or wrong grade of oil. Drain crankcase and refill with proper oil (para 2-96).
1. ENGINE LACKS POWER	
Step 1.	Fuel pump not operating properly. Refer to paragraph 2-84 and test fuel pump. Replace defective pump.
Step 2.	Check for dirty or faulty carburetor. Clean or replace carburetor (para 2-83).
Step 3.	Check for faulty spark plugs. Replace plugs (para 2-91).
Step 4.	Check for burned, pitted, or sticking ignition points. Replace points (para 2-90).
. BATTERIES DISCHARGE WITH ENGINE RUNNING	
	Check for loose alternator V-belt or faulty alternator. Adjust V-belt tension or replace faulty alternator. (para 2-88).
. LIGHTS FAIL	
Step 1.	Check for defective or burned out lamps. Replace lamps (para 2-51).
Step 2.	Check for defective wiring. Repair or replace wiring (para 2-50).
Step 3.	Check for defective switch. Replace switch (para 2-55)
Step 4.	Check for faulty ground. Clean ground terminals
. REVOLVING FRAME TEETERS	
	Check hook rollers for improper adjustment. Adjust hook rollers (para 2-111).
. HEATER MOTOR INOPERATIVE	
Step 1.	Check wiring. Replace faulty wiring (para 2-68).
Step 2.	Check heater blower motor. Replace defective motor.
. HEATER DELIVERS COLD AIR	
Step 1.	Check for stuck thermostat. Replace defective thermostat.
Step 2.	Check for blocked heater hose. Repair or replace hose.
Step 3.	Check for air lock in water line to heater. Disconnect heater hose and drain line until air block is bled from system.
Step 4.	Check for dirt on outside of coil. Remove cover and clean outside of coil.
Step 5.	Check for sediment in inside of coil. Remove input and output hoses and flush coil with suitable solvent.
. HEATER DOES NOT DELIVER AIR	
Step 1.	Check for inoperative heater motor. Refer to malfunction 14 above.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 2. Check for loose fan on electric motor shaft.	Remove motor and tighten fan on motor shaft.
17. HEATER LEAKS	Check for broken coil.	Replace coil.

Section VII. RADIO INTERFERENCE SUPPRESSION

2-21. General Methods Used to Attain Proper Suppression

Essentially, suppression is attained by providing a low resistance path to ground for stray currents. The methods used include shielding the ignition wires, grounding with bonding straps, and using capacitors and resistors.

2-22. Interference Suppression Components

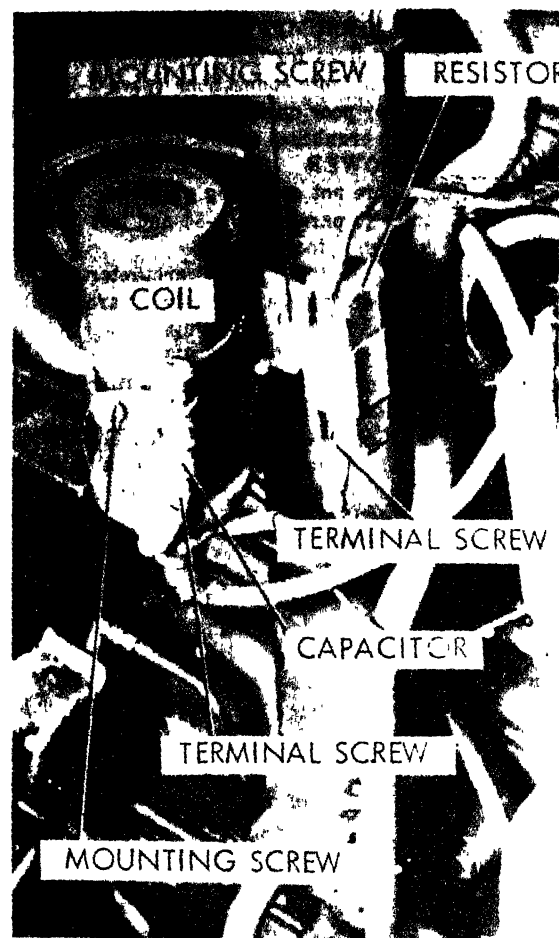
The primary suppression components are those whose primary function is to suppress radio interference. On this machine, the primary interference suppression components are the 0.25 microfarad capacitor mounted on the side of the ignition coil and the 0.450-0.475 ohm resistor illustrated in figure 2-31.

2-23. Replacement of Suppression Components

Refer to figure 2-31 and replace the radio interference suppression resistor and capacitor. Refer to figure 2-92 and replace secondary radio suppression components, which are spark plug leads and lead from distributor to ignition coil.

2-24. Testing of Radio Interference Suppression Components

Test capacitor for leaks and shorts on a capacitor tester; replace defective capacitors. If test equipment is not available and interference is indicated, isolate that cause of interference by the trial-and-error method of replacing the capacitor or interference suppression lead, in turn, until the cause of interference is located and eliminated.



STEP 1. REMOVE THE TERMINAL SCREWS, AND MARK AND DISCONNECT THE ELECTRICAL LEADS TO THE CAPACITOR AND RESISTOR.

STEP 2. REMOVE THE MOUNTING SCREWS AND THE CAPACITOR AND RESISTOR.

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Figure 2-31. Radio interference resistor and capacitor, removal and replacement.

Section VIII. MAINTENANCE OF SHOVEL FRONT ATTACHMENT

2-25. General

a. This section contains instructions for service, adjustment, repair and replacement of the shovel front attachment and components.

b. Use a crane or other adequate lifting device for removing and installing components.

2-26. Shovel Front Attachment

a. *Service.* The shovel front must be lubricated at the periodic intervals listed in the current lubrication order (LO 3810-294-12). When removed from the machine, all exposed finished surfaces must also be lubricated as often as required to prevent damage due to rust and corrosion. If possible, the entire attachment should be placed inside a suitable dry building, preferably on wooden blocking. The shovel front should be cleaned with cleaning solvent. Paint the shovel boom as required to prevent rust and corrosion. (Refer to TM 9-213.)

b. *Adjustments.* Each of the following adjustments must be checked after every 40 hours of shovel operation. Adjust only if necessary.

(1) *Saddle block adjustment.* Shims and wear plates are used to adjust the clearance between the dipper stick and the saddle block wear plates as shown in figure 2-32. The desired minimum clearances between wear plates and saddle blocks are 1/64-inch at each location. Adjustment is mandatory when clearance reaches 1/16-inch at any point illustrated. Use the following procedure for adjustment:

(a) Support the dipper stick in horizontal position, using the hoist line.

(b) Divide the dipper stick into three approximately equal lengths, using chalk marks or paint.

(c) Move the dipper stick back and forth a few times to make sure it is free in the saddle blocks and in its normal operating condition.

(d) Position the dipper stick so that the outer third of the dipper stick, as measured by the chalk or paint marks, is located in the saddle block. Measure the clearance between the wear plates on each side of the dipper stick and the dipper stick. Record the measured distance.

(e) Measure the clearance between the top of the dipper stick and the wear plate at each end of the saddle block and record the measured distance.

(f) Repeat steps (d) and (e) above for each of the other two marked sections of the

dipper stick, each time recording the measurements.

(g) Loosen wear plate bolts and insert shims beneath the wear plates until the clearance between the dipper stick and the wear plates is approximately 1/64-inch at the thickest point of the dipper stick. Adjust both top and side clearances in this manner.

NOTE

Shims are slotted so they may be tapped into place without removing wear plates.

(2) *Crowd chain adjustment.* Adjust for crowd chain wear as illustrated in figure 2-24. Total midspan chain slack at top of chain must be maintained at approximately 1/4-inch.

(3) *Rake angle adjustment.* Refer to figure 2-33 and adjust the dipper pitch braces in accordance with type of material being moved and working conditions. In general, pin the pitch brace in hole 1 for easy digging and low bank cuts. Pin the brace in hole 2 for medium or average soil conditions and bank heights, and in hole 3 for hard digging, high banks, and when grading the area.

(4) *Retract cable tension adjustment.* Refer to figure 2-34 and adjust retract cable tension.

(5) *Dipper trip cable adjustment.* This adjustment should not be necessary unless the dipper trip cable wears or stretches. Therefore, the cable should be inspected to determine that it is safe for further use before it is adjusted. Refer to figure 2-34 and adjust the dipper trip cable tension.

(6) *Dipper latch bar adjustment.* The dipper latch bar must be adjusted to move forward into the opening in the dipper latch as latch bar wear occurs. Refer to figure 2-35 and adjust the dipper latch bar.

c. *Shovel Front Replacement.* Refer to paragraph 2-9 for removal or replacement of the shovel front attachment.

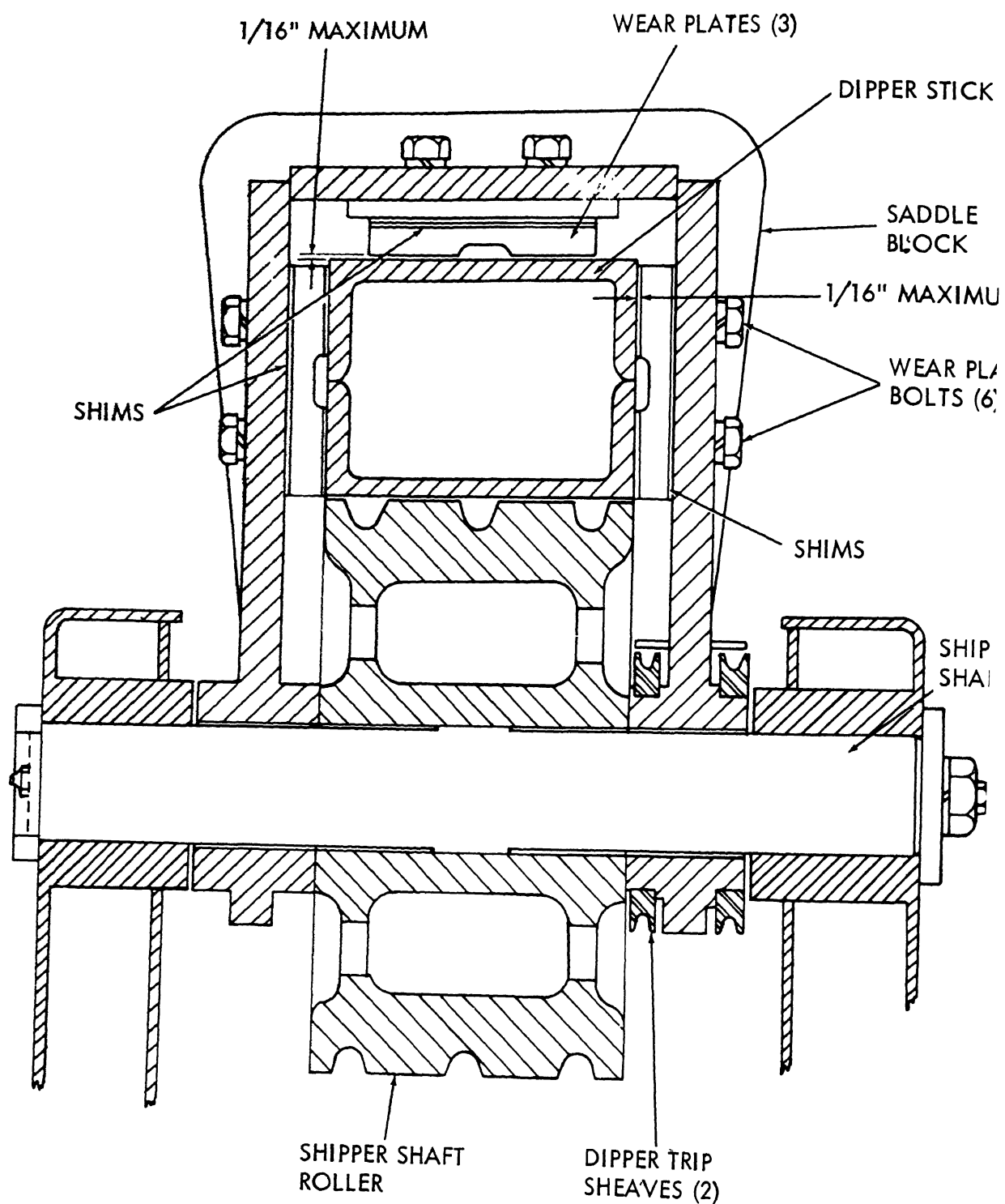
2-27. Idler Sprocket Replacement

a. Inspect sprockets for wear or other defects. Replace a badly worn or defective sprocket to prevent excessive chain wear.

b. Refer to figure 2-36 and remove or replace the idler sprocket assembly by removing the attaching bolts.

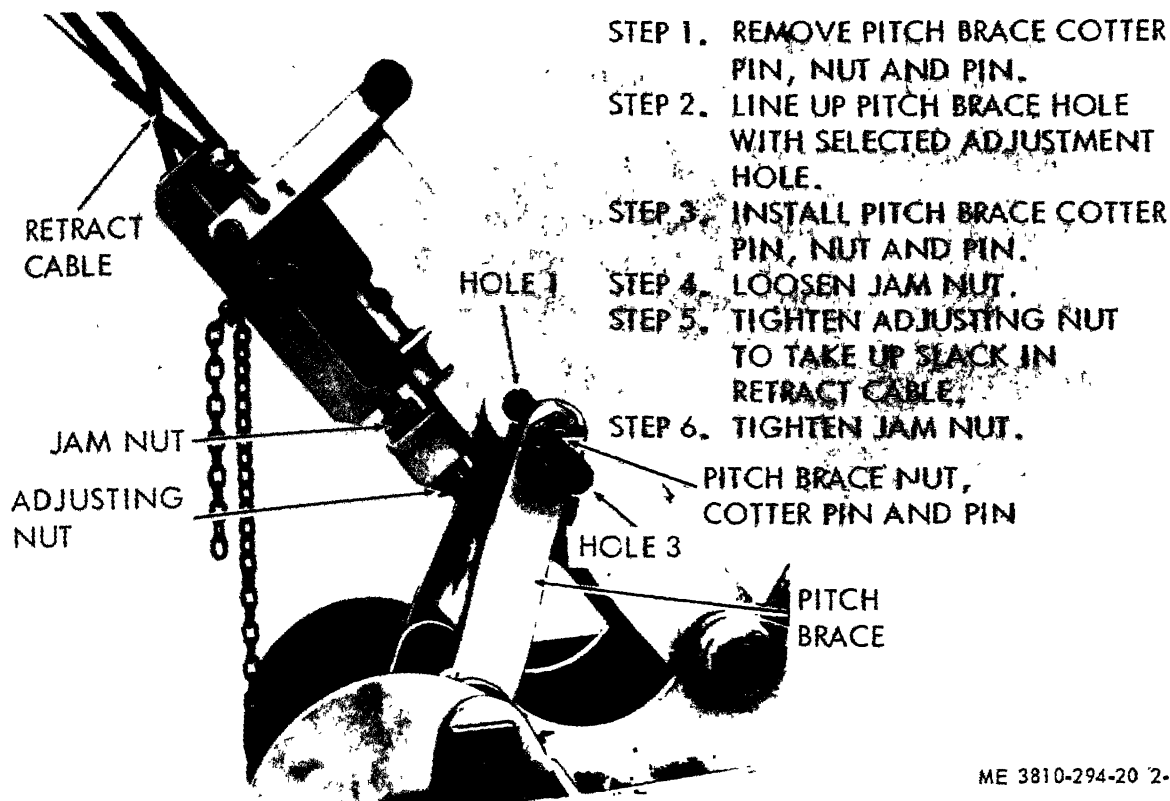
2-28. Crowd Chain

a. *Replacement.* The crowd chain may be opened at any point for chain replacement. The



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Figure 2-32. Adjusting saddle block.



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Figure 2-33. Rake angle and retract cable adjustment.

easiest point will be at the boom foot drum sprocket, since the chain is accessible and supported by the sprocket. To open the chain, chisel off the cotter pin (fig. 2-36) and drive out the chain connecting pin at the point shown. To re-install the pin, wrap the chain around the two sprockets as shown. Make sure the chain points in the direction shown in figure 2-37. Then support the chain on one side with a heavy hammer or steel plate while installing the connecting pin and a new cotter pin.

b. *Repair.* If a single section of unworn chain should break, refer to figure 2-38 and repair the chain by replacing the broken link.

2-29. Dipper Trip Motor Magnetic Switch and Wire Leads

a. Refer to the dipper trip wiring diagram, figure 2-39. When the shovel attachment is in-

stalled, the dipper trip pushbutton switch is mounted on a bracket on the front drum clutch lever. If closing the dipper trip pushbutton will not actuate the dipper trip mechanism, first check the batteries (para 2-53).

b. Refer to figure 2-40 and replace the dipper trip motor magnetic switch and wire leads.

2-30. Dipper and Dipper Teeth Replacement

a. *Dipper Replacement.* Refer to figure 2-41 and remove or replace the shovel dipper.

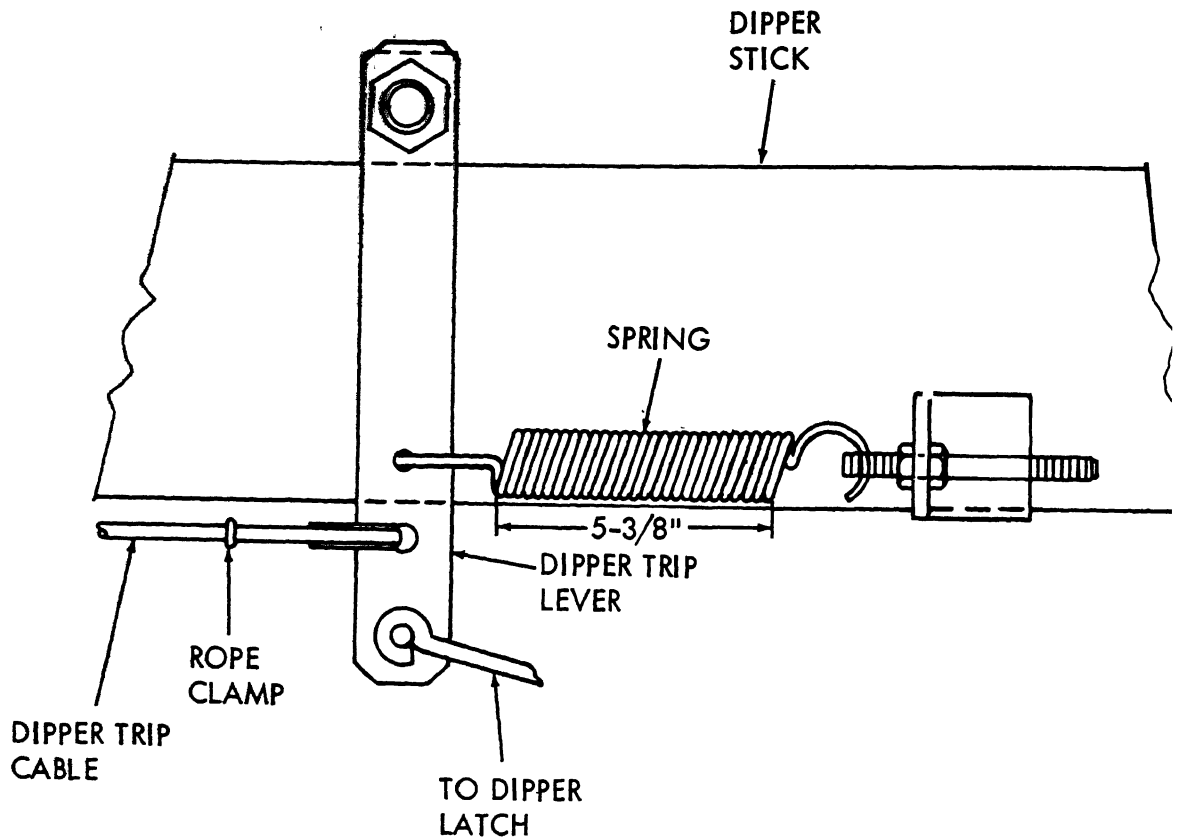
b. *Dipper Tooth Replacement.* Drive out the attaching pins and replace dipper teeth.

NOTE

Dipper teeth can be kept sharp in service by regularly reversing them, top for bottom, as they wear. However, when teeth are worn to about one third their original length, they must be replaced.

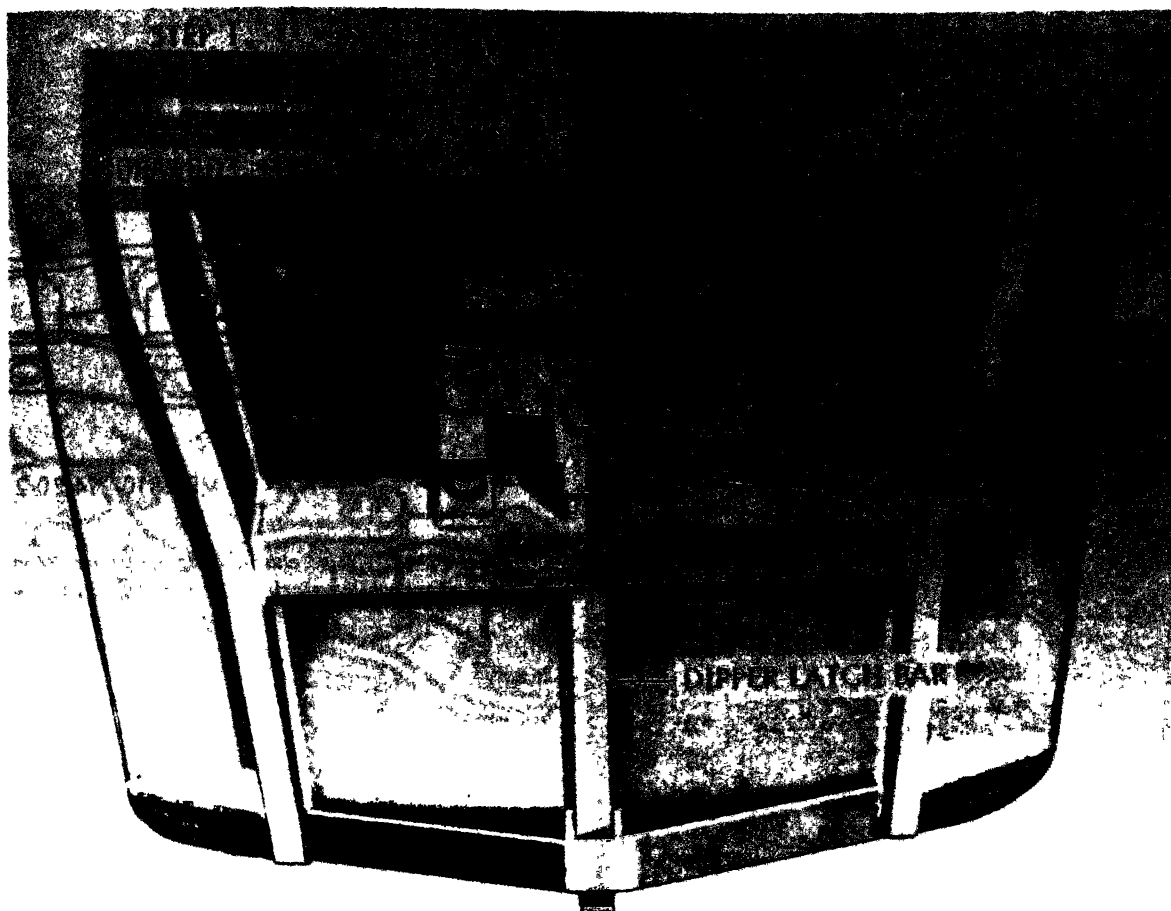
- STEP 1. LOOSEN ROPE CLAMP.
- STEP 2. TIGHTEN DIPPER TRIP CABLE UNTIL DIPPER TRIP LEVER IS AT RIGHT ANGLE TO DIPPER STICK.
- STEP 3. TIGHTEN ROPE CLAMP.

NOTE: SPRING LENGTH SHOULD NOT BE CHANGED. MAKE DIPPER TRIP LEVER ADJUSTMENT BY METHOD SHOWN, LEAVING SPRING ADJUSTMENT UNDISTURBED.



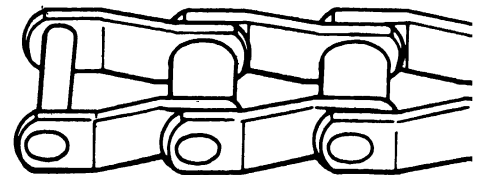
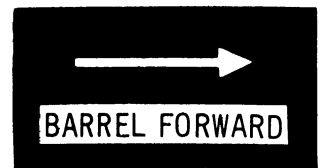
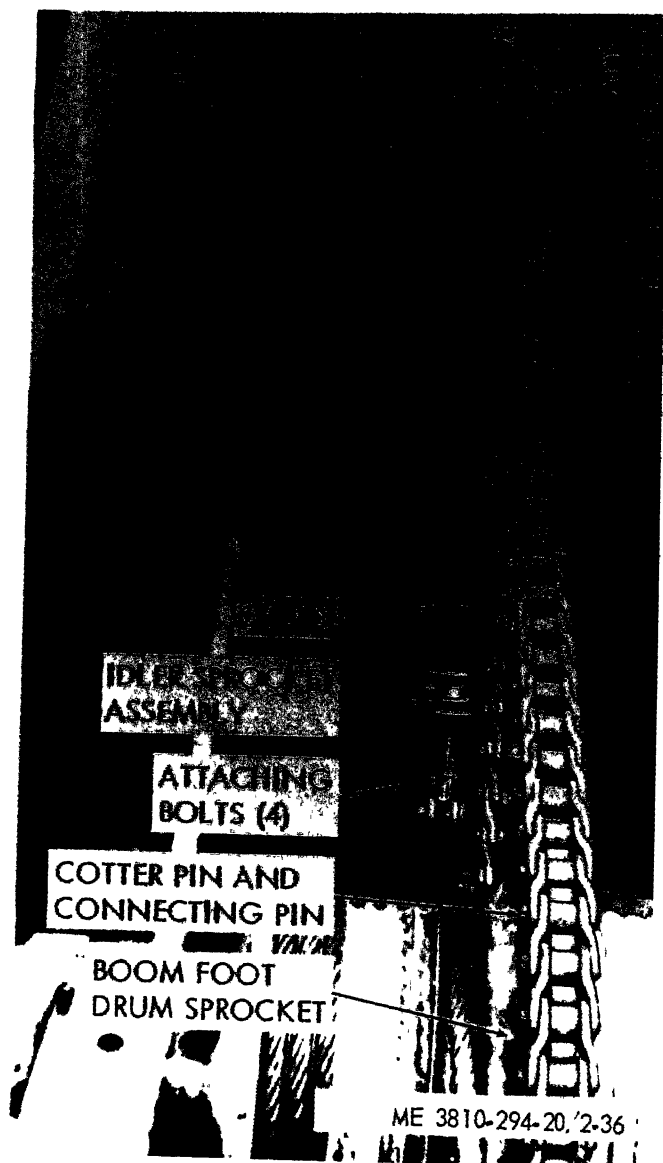
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Figure 2-34. Dipper trip cable adjustment.



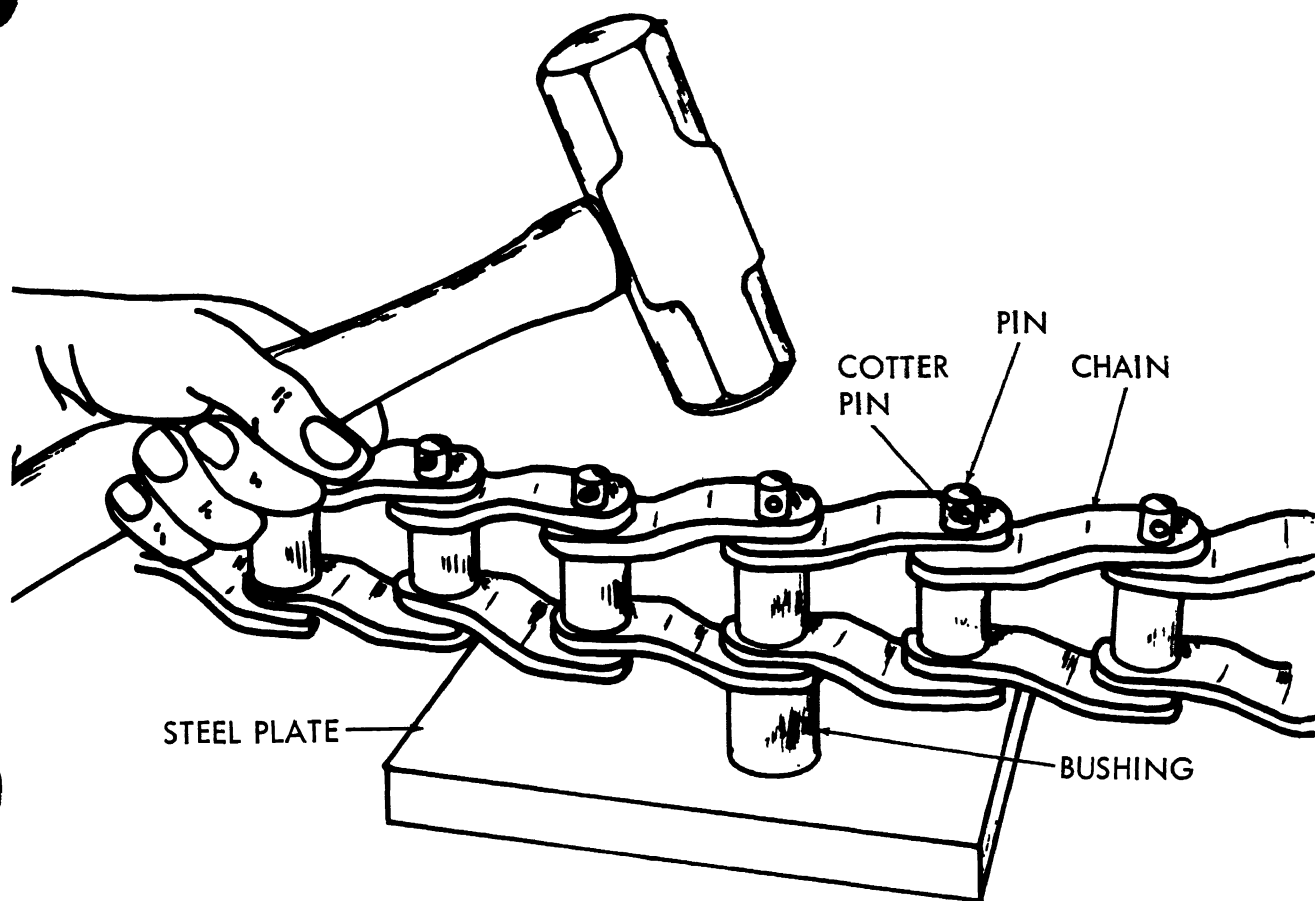
ME 3810-294-20 2-35

Figure 2-35. Dipper latch bar adjustment.



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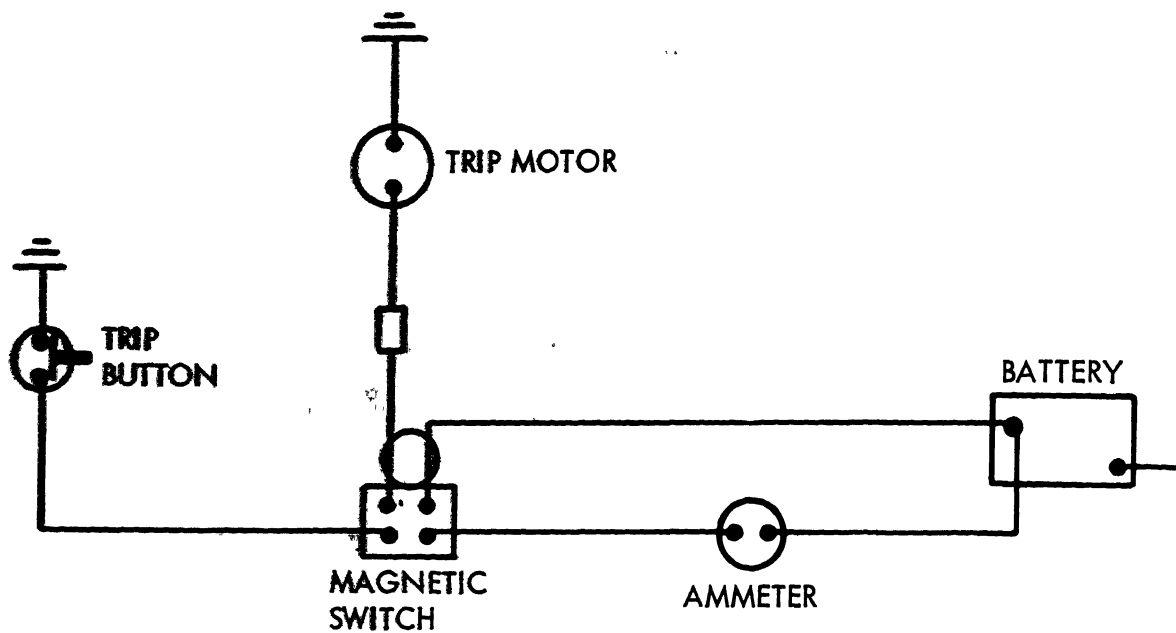
Figure 2-37. Crowd chain, direction of travel from above while entering drive sprocket in direction.



- STEP 1. PLACE THE CHAIN ON STEEL PLATE WITH BUSHING BENEATH PIN. BUSHING MUST HAVE HOLE LARGER THAN PIN, AND MUST BE LONG ENOUGH TO ALLOW PIN TO MOVE.
- STEP 2. STRIKE THE PIN VERY SHARPLY. HIT IT HARD. THIS WILL DRIVE THE PIN FROM THE CHAIN, WHILE CUTTING OFF COTTER PIN.
- STEP 3. INSTALL NEW PIN AND DRIVE COTTER PIN IN PLACE. DO NOT FILE DOWN PINS TO AID IN INSTALLING. PRESS FITS ARE NEEDED FOR CHAIN LIFE.

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Figure 2-38. Chain, repair and replacement.



ME 3810-294-2

Figure 2-39. Dipper trip wiring diagram.



- STEP 1. DISCONNECT ELECTRICAL LEADS.
- STEP 2. REMOVE CAPSCREWS AND LOCKWASHERS.
- STEP 3. REMOVE MAGNETIC SWITCH.

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Figure 2-40. Dipper trip magnetic switch, removal.

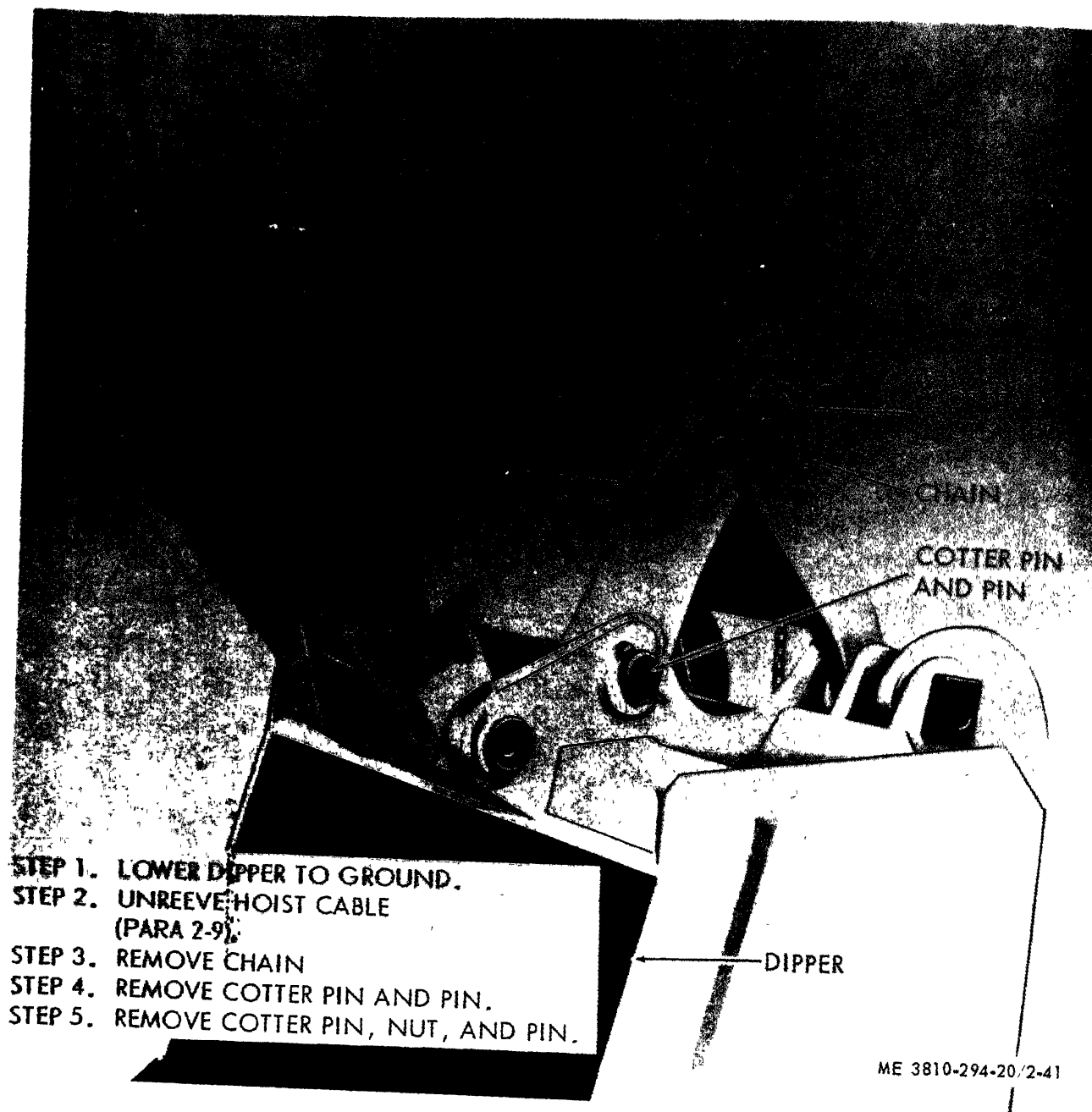


Figure 2-41. Shovel dipper, removal and installation.

Section IX. MAINTENANCE OF BACKHOE ATTACHMENT

2-31. General

a. This section contains instructions for service, adjustment, repair, and replacement of the backhoe front end attachment and its components.

b. Use a crane or other adequate lifting device for removing or installing components.

2-40

2-32. Backhoe Front Attachment

a. *Service.* Keep the backhoe attachment lubricated in accordance with LO 5-3810-294-12. When the attachment is not in use, it should be placed on wooden blocks, if possible, and should be cleaned with cleaning solvent. All machined or finished surfaces must be kept lubricated as required to prevent rust.

Dipper Assembly Pitch Adjustment. Refer paragraph 2-8d and adjust the backhoe pitch

Repair and Replacement.

- 1) Inspect sheaves and sheave bushings. Replace faulty sheaves or sheave bushings as indicated in paragraph 2-8.
- 2) Inspect all parts for wear, defects, or failure of any type, and repair or replace defective parts.
- 3) Replace side cutters if they are dull or damaged.
- 4) Refer to paragraph 2-8 for removal or replacement of backhoe front attachment or components.

Dipper Assembly

General. The dipper assembly consists of dipper, dipper teeth, side cutters, attaching pins and bushings, and bracket assembly, block, and link assembly. The dipper is attached to the handle and pitch brace assembly. It is actuated by pull cables through the bracket assembly, and link assembly.

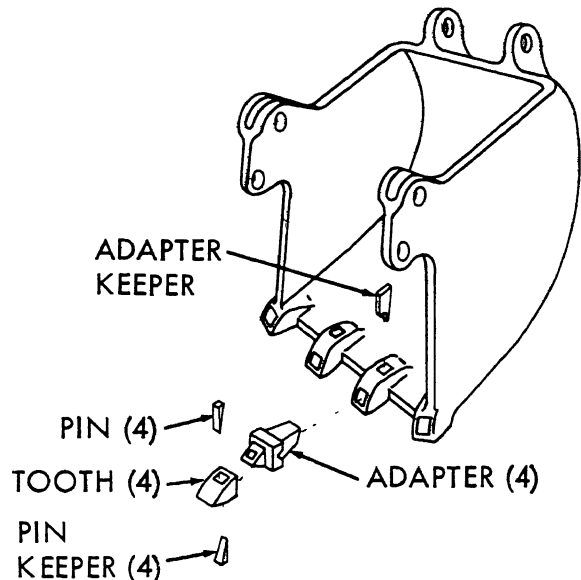
Removal.

- 1) Lower dipper to rest on blocks, then disconnect drag cable from bracket assembly, block, and link assembly.
- 2) Remove cotter pins and washers from handle and pitch brace pins. Remove handle and pitch brace pins and remove dipper and bracket assembly, block, and link assembly from handle.

Cleaning, Inspection and Repair.

- 1) Clean parts and attaching hardware with cleaning solvent.
- 2) Inspect parts and attaching hardware for damage and wear.
- 3) Inspect teeth and side cutters for wear and damage.
- 4) Inspect bracket assembly, block, and link assembly for worn or damaged links, broken

- STEP 1. DRIVE OUT PIN AND PIN KEEPER.
- STEP 2. INSTALL NEW TEETH.
- STEP 3. IF NECESSARY, DRIVE OUT ADAPTER KEEPER AND ADAPTER AND REPLACE.



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Figure 2-42. Dipper teeth, removal and replacement.

pins, and missing parts. Inspect sheaves and bushings for wear and damage.

(5) Repair or replace damaged, worn, or missing parts.

d. Dipper Teeth Replacement. Dipper teeth must be replaced when they are worn to about one third their original length. Refer to figure 2-42 and replace dipper teeth.

Section X. MAINTENANCE OF PILEDRIVER ATTACHMENT

General

Maintenance of the piledriver attachment consists of service, inspection, repair, and replacement.

Use a crane or other adequate lifting device for removing and installing components.

Piledriver Rig

Service. Keep the piledriver rig clean, well

painted, and keep machined surfaces lubricated in accordance with LO 5-3810-294-12.

b. Repair. Inspect the piledriver rig for faulty welds, bent lacings, or other damage to structural members. Any damaged item which affects structural strength must be repaired or replaced.

c. Replacement. Refer to paragraph 2-7 for replacement of the piledriver rig.

Section XI. MAINTENANCE OF CRANE, DRAGLINE, AND CLAMSHELL ATTACHMENTS

2-36. General

a. This section contains instructions for service, repair, and replacement of the crane, dragline, and clamshell attachments. Each attachment uses the same crane boom. The components of the crane attachment must be lubricated at the periodic intervals listed in lubrication order (LO 5-3810-294-12). When removed from the machine, the crane boom should be placed inside a suitable dry building, if possible, preferably supported on wooden blocking.

b. Use a crane or other adequate lifting device for removing and installing components.

2-37. Crane Boom Maintenance

a. *Service.* Clean the crane boom using a suitable cleaning solvent. Keep all machined or finished surfaces lubricated, as required, to prevent rust.

b. *Boom Replacement.* Refer to paragraph 2-4 for replacement of crane boom.

2-38. Pulley Roller Guides

a. *General.* Roller guides are provided to assist in guiding the cable on the boom point sheaves and prevent friction contact with the boom.

b. *Service.* Refer to figure 2-43 and clean the cable roller guides and boom point sheaves. Inspect for wear, scoring, or grooving caused by contact between cables, rollers, or sheaves.

c. *Replacement.* Refer to figure 2-44 for removal of cable guide rollers. Installation procedure is reverse of removal.

2-39. Hook Block Service and Replacement

a. Lower the hook block (fig. 2-45) to the ground or to suitable blocking.

b. Lubricate the pulley block sheaves in accordance with LO 5-3810-294-12.

c. Loosen the cable clamp at the cable dead end. This may be at the boom point or the hook block, depending on the number of parts of line in use. Manually unreeve the hook block. Refer to the reeving diagram, figure 2-11.

2-40. Tagline Service, Adjustment, and Repair

a. *General.* The tagline winder is used to prevent lateral movement of the clamshell bucket during operation.

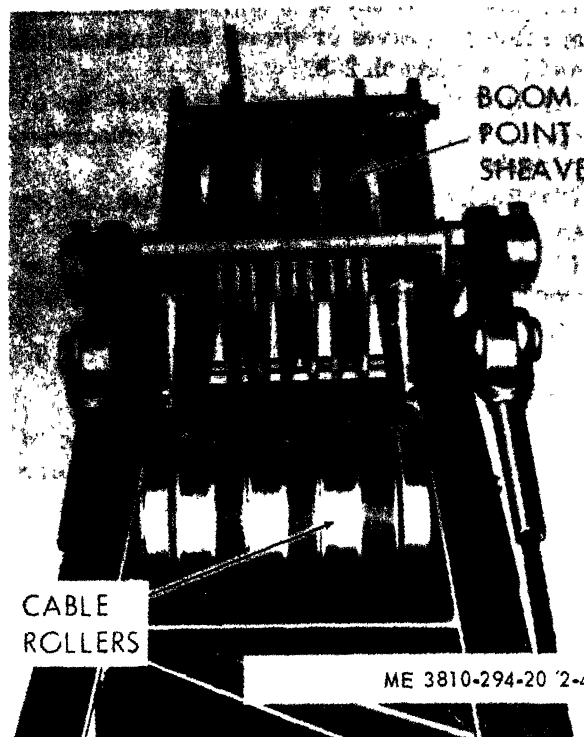
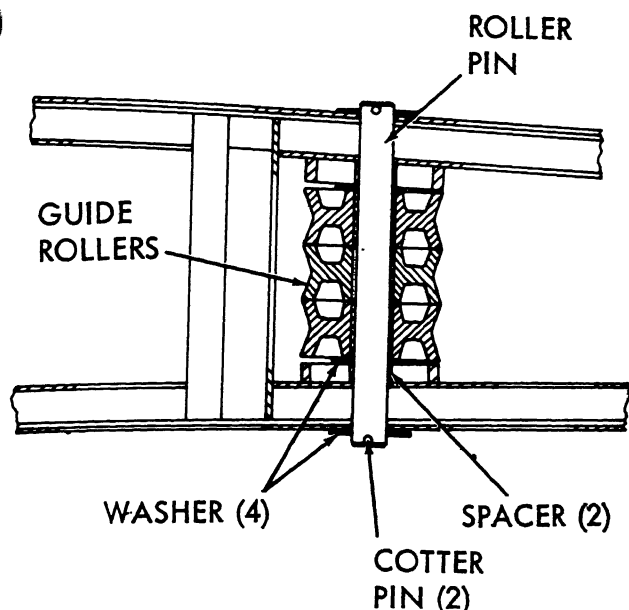


Figure 2-43. Cable roller and boom point sheaves service.

b. *Service.* The tagline winder must be kept clean. It must be lubricated in accordance with LO 5-3810-294-12. Be sure the level of lubricant is checked at least semi-annually.

c. *Adjustment.* The tagline must be capable of providing sufficient tension to keep the bucket from turning and fouling the clamshell hoisting and closing lines. The approximate tension required on this tagline is 195 pounds. To increase tension, pull the cable out enough to allow an additional wrap on the cable drum. The amount of tension can be varied to suit individual operator preference. The recommended tension is from two-to four-wraps on the tagline drum.

d. *Replacement.* The tagline winder is mounted to the crane boom as shown in figure 2-12. Mount the tagline winder at the tip of the boom base section so that a line drawn through the cable drum lines up with the boom point.



- STEP 1. REMOVE COTTER PIN AT EITHER END.
- STEP 2. REMOVE EXTERNAL WASHER AT END COTTER PIN WAS REMOVED.
- STEP 3. PRESS ROLLER PIN OUT FROM END COTTER PIN WAS REMOVED. REMOVE SPACERS AND GUIDE ROLLERS.

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Figure 2-44. Cable guide rollers, removal.

2-41. Bridle Assembly Service, Replacement, and Repair

a. *General.* The bridle assembly contains the sheaves for the boom hoist cable and provides the point of attachment for boom guy cables. The bridle assembly is sometimes called the spreader assembly.

b. *Removal.* Refer to paragraph 2-4 and remove the bridle assembly.

c. *Service and Repair.* Refer to figure 2-46. Clean and inspect sheave bushings for signs of wear or damage and replace damaged bushings. Inspect sheaves for wear, grooving, or cracks, and replace worn or damaged sheaves. Inspect sheave pins for wear or scoring and smooth small rough points with a fine file or emery cloth. Replace severely worn or scored pins. Clean sheaves with solvent, removing all old lubricant. Inspect lubrication fittings and make sure

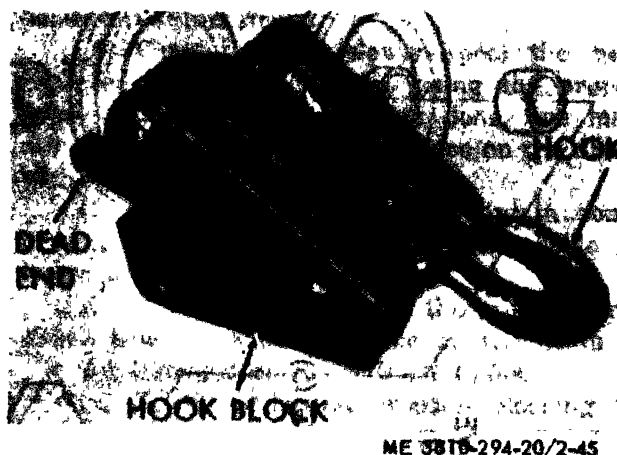


Figure 2-45. Hook block.

that passages are open and have been receiving the lubricant.

NOTE

A properly grooved sheave has smooth side walls and the groove is only slightly wider than the cable. Use a light layer of lubricant when reinstalling pins, bushings, and other fitted parts. Be sure lubrication fittings are properly installed and line up with grease holes.

d. *Installation.* Refer to paragraph 2-4d and install the bridle assembly.

2-42. Clamshell and Dragline Bucket Service, Replacement, and Repair

a. *Service.* The bucket must be kept clean and wear points must be kept lubricated in accordance with LO 5-3810-294-12.

b. *Replacement.*

(1) *Clamshell bucket.* Refer to paragraph 2-5 for removal and installation of the clamshell bucket.

(2) *Dragline bucket.* Refer to paragraph 2-6 for dragline bucket removal and installation.

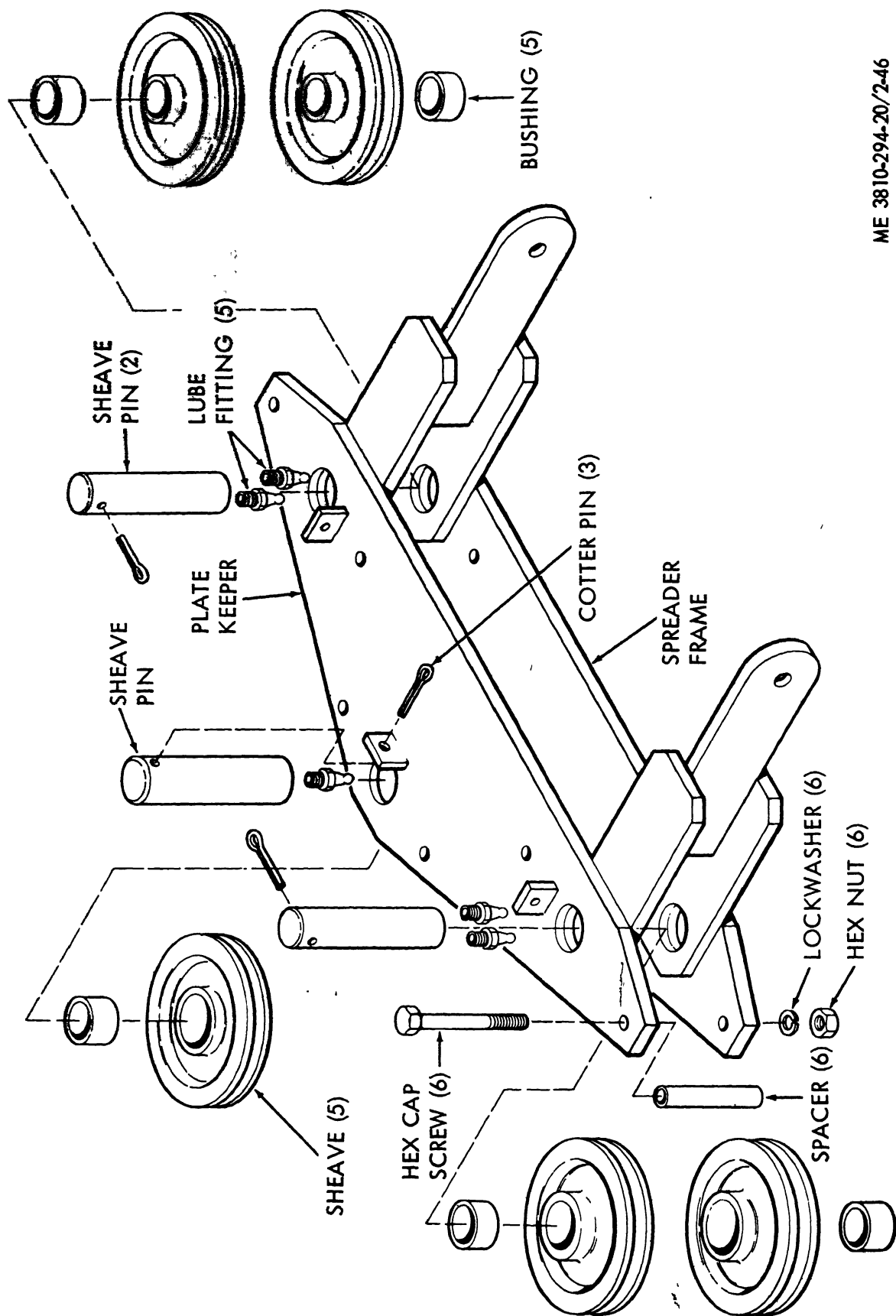
(3) *Bucket teeth.* When teeth are worn to about one third of their original length, drive out the attaching pins and replace bucket teeth (fig. 2-42).

NOTE

Dragline bucket teeth can be reversed, top for bottom, to equalize wear and keep them sharp during operation.

(4) *Dump cable.* Replace dump cable when it is frayed or worn.

(5) *Sheave bushings.* Replace sheave bushings and sheaves as described in paragraph 2-41c.



2-43. Fairlead, Service and Replacement

a. Service.

(1) Inspect for excessive grooving of fairlead sheaves or rollers.

(2) Lubricate in accordance with LO 5-3810-294-12.

b. Replacement.

(1) The fairlead is mounted on a bracket located on the front of the revolving frame. Use a suitable lifting device for removal and installation.

(2) Refer to figure 2-13. Remove nuts, lockwashers, and U-bolts, and remove fairlead. Replace fairlead as described in steps 1 and 2 of figure 2-13.

2-44. Boom Jib Mast, Service and Replacement

a. *General.* The boom jib mast is also called the jib strut and is used to support the jib when a jib is in use.

b. *Jib and Jib Strut Service.* Service for the jib and jib strut is the same as for the crane boom. Refer to paragraph 2-37a and service the jib and jib strut.

c. *Jib and Jib Strut Replacement.* Refer to figure 2-47 and replace the jib and jib strut.

2-45. Cable Replacement

a. *General.* To replace either the front or the rear drum load cable, place the drum brake for the cable to be removed in the brake released position.

b. Replacement of Load Cables.

(1) Lower the hook block to the ground or to suitable blocking.

(2) Loosen the cable clamp at the cable dead end. This may be at the boom point or the hook block, depending on the number of parts of line in use.

(3) Manually unreeve the hook block (fig. 2-11).

(4) Raise the boom to any convenient height so that the line hangs downward. One man can then pull the cable off the drum. When the cable end is reached, refer to figure 2-10 and remove the cable wedge from the drum lagging.

(5) To install the new cable, place the new cable reel beneath the boom point sheaves.

(6) Run the end of the new cable over the boom point sheaves to the correct main drum.

(7) Refer to figure 2-10 and install the new cable wedge in the drum, being careful that

the cable goes over the top of the rear drum, or beneath the front drum.

(8) Carefully and slowly spool the new cable on the selected drum, using the proper drum clutch lever. As this is done, one man should tap the new cable into place on the drum with a soft hammer.

(9) A second man should maintain some drag on the new cable reel so the cable is under tension.

(10) A third man operates the proper drum clutch lever to wind the cable on the drum.

c. Replacement of Boom Hoist Cable.

(1) Provide adequate wooden blocking to support the boom.

(2) Lower boom until it is supported on blocking as illustrated in figure 2-3.

(3) Pay off more cable until the upper spreader lies on the boom.

(4) Refer to figure 2-48 and disconnect the boom hoist cable from the lower spreader.

(5) Release the boom hoist pawl and the boom hoist brake (TM 5-3810-294-10).

(6) Unreeve the boom hoist line and pull it from the boom hoist drum.

NOTE

The boom hoist drum may be used to pay the line off the drum under power if the operator desires. When this is done, one man standing on the ground must pull the cable out of the cab.

(7) Refer to figure 2-10 and remove the cable wedge to complete removal of the cable.

(8) Position the new cable reel close to the upper spreader and near the boom.

(9) Starting at the center (equalizer) sheave of the upper spreader, reeve the boom hoist cable back to the dead end on the lower spreader as shown in figure 2-48.

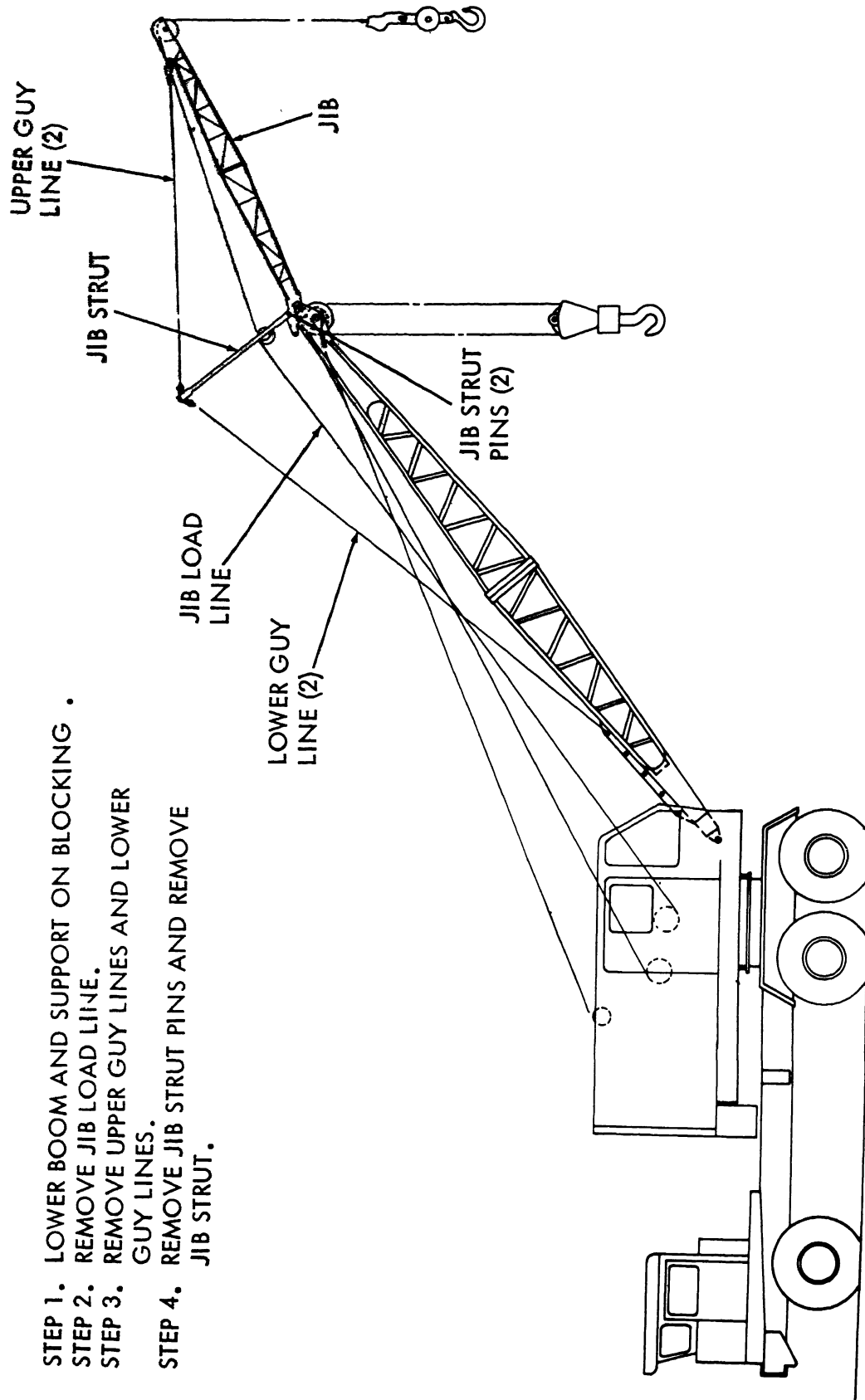
(10) Pull the rest of the cable off the new cable reel and reeve the other half of the boom hoist cable back to the boom hoist drum, as shown in figure 2-9.

(11) Install new cable wedge in the boom hoist drum as shown in figure 2-10.

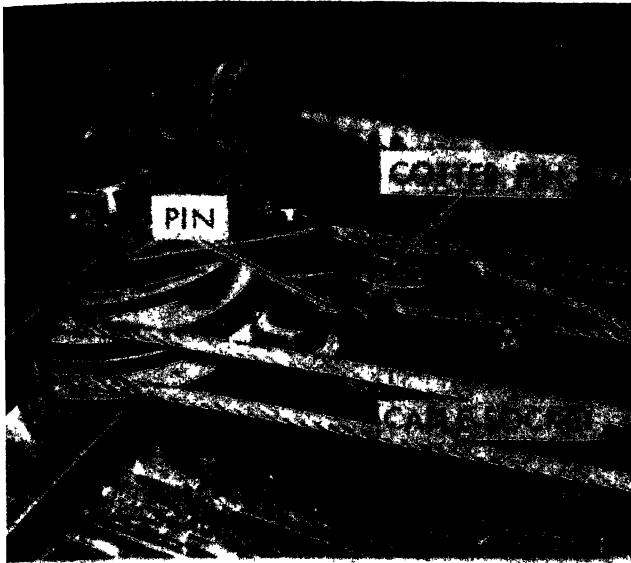
(12) Carefully and slowly spool the new cable on the boom hoist drum. As this is done, one man should tap the new cable into place with a soft hammer.

2-46. Pulleys (Boom Point Sheaves) Service and Replacement

a. *General.* Boom point sheaves are illustrated in figure 2-49. They provide low friction pivot points for load cable movement.



- STEP 1. LOWER BOOM AND SUPPORT ON BLOCKING .
- STEP 2. REMOVE JIB LOAD LINE.
- STEP 3. REMOVE UPPER GUY LINES AND LOWER GUY LINES.
- STEP 4. REMOVE JIB STRUT PINS AND REMOVE JIB STRUT.



- STEP 1. LOWER BOOM TO SUITABLE SUPPORT.
- STEP 2. ENGAGE BOOM HOIST PAWL.
- STEP 3. REMOVE COTTER PIN AND PIN.
- STEP 4. REMOVE CABLE SOCKET AND PLACE ON NEW CABLE.
- STEP 5. INSTALL PIN AND COTTER PIN.

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Figure 2-48. Boom hoist cable, lower spreader connection, removal and replacement.

b. *Service.* Clean the boom point sheaves and lubricate in accordance with LO 5-3810-294-12.

c. *Replacement.*

(1) Refer to figure 2-49 and remove boom point sheaves.

(2) Reverse sequence of steps in figure 2-49 to install sheaves.

2-47. Backstop Assembly, Replacement

a. *General.* Boom backstops are provided strictly as a means of giving an operator a visual way of telling when the boom has been raised to the maximum limit. They must never be used to prevent the boom from being raised too high.

b. *Removal.*

(1) Refer to figure 2-6(2). Remove cotter pins and backstop pins at gantry.

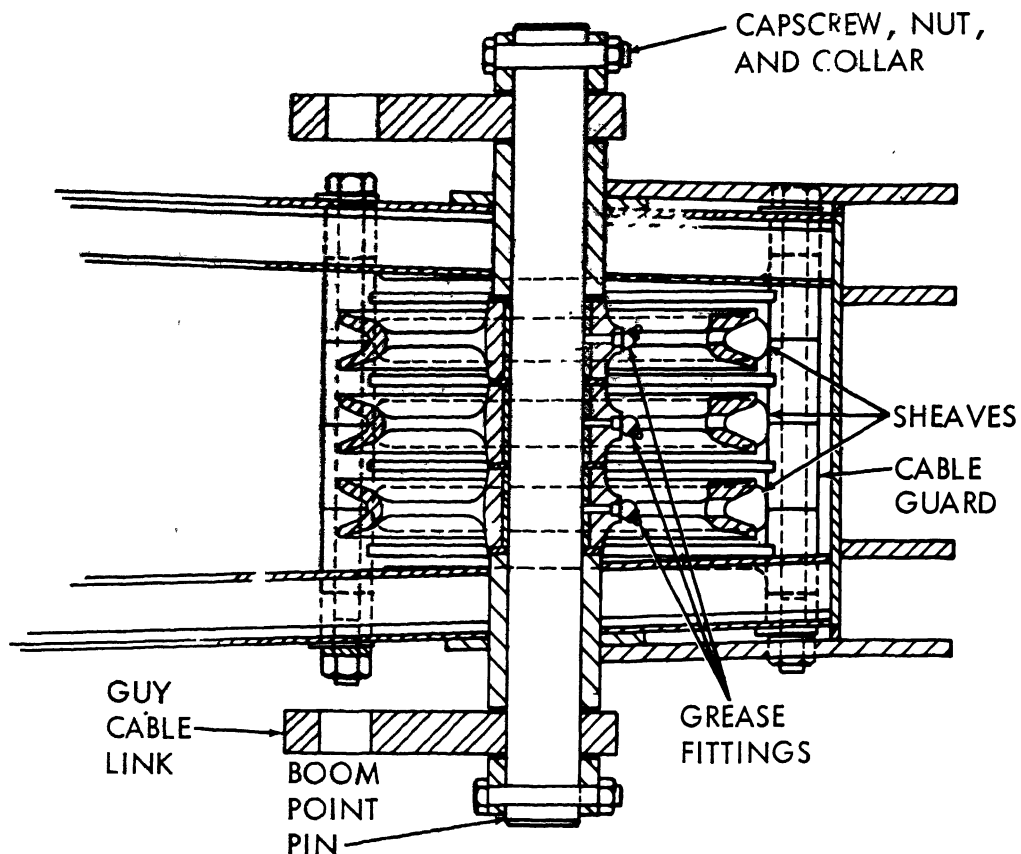
(2) Refer to figure 2-6(1). Remove cotter pins and backstop pins and remove boom backstop from boom.

c. *Installation.* Install boom backstop between the gantry and boom as shown in figure 2-6(1) and 2-6(2).

2-48. Angle Indicator, Replacement

a. Refer to figure 2-7. Remove nuts, lockwashers, and bolts and remove angle indicator.

b. Install angle indicator as shown in figure 2-7.



- STEP 1. LOWER BOOM TO REST ON ADEQUATE SUPPORT.
- STEP 2. REMOVE CAPSCREW, NUT, AND COLLAR ON EACH SIDE.
- STEP 3. REMOVE GUY CABLE LINK.
- STEP 4. SUPPORT SHEAVES SO THEY CAN NOT FALL.
- STEP 5. USE WOODEN BLOCK AND HAMMER AND DRIVE BOOM POINT PIN OUT.
- STEP 6. REMOVE SHEAVES.

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Figure 2-49. Boom point sheaves, replacement.

Section XII. MAINTENANCE OF HULL WIRING HARNESS

2-49. General

Wiring must be regularly inspected for frayed insulation, broken wires, corroded terminals, loose terminal and ground connections, and broken or missing cable clamps. Check electrical connections at the control panel for tightness.

2-50. Hull Wiring Harness Repair

Repair a damaged or broken wire by cutting length of wire of the same size and color and taping it along the harness. Install a clip each end, and remove the faulty wire. Secure the ends of the new wire to the remaining ends of the old wire, and insulate the connections with electrical tape.

Section XIII. MAINTENANCE OF LIGHTS, BATTERIES, AND MISCELLANEOUS ITEMS

2-51. Lights

a. *General.* All components of the lighting system are illustrated in figures 2-50 and 2-51.

b. *Headlights.* Refer to figure 2-50 and replace headlights.

c. *Marker Lights, Dome Lights, Flood Lights, and Trouble Lights.* Each of the various types

- STEP 1. REMOVE SCREWS.
 STEP 2. REMOVE HEADLIGHT GUARD.
 STEP 3. REMOVE TWO SCREWS WHICH ATTACH HEADLIGHT CLAMP AND REMOVE HEADLIGHT.
 STEP 4. REPLACE HEADLIGHT, INSTALL LEAD LIGHT CLAMP AND SCREWS. INSTALL HEADLIGHT GUARD AS SHOWN.

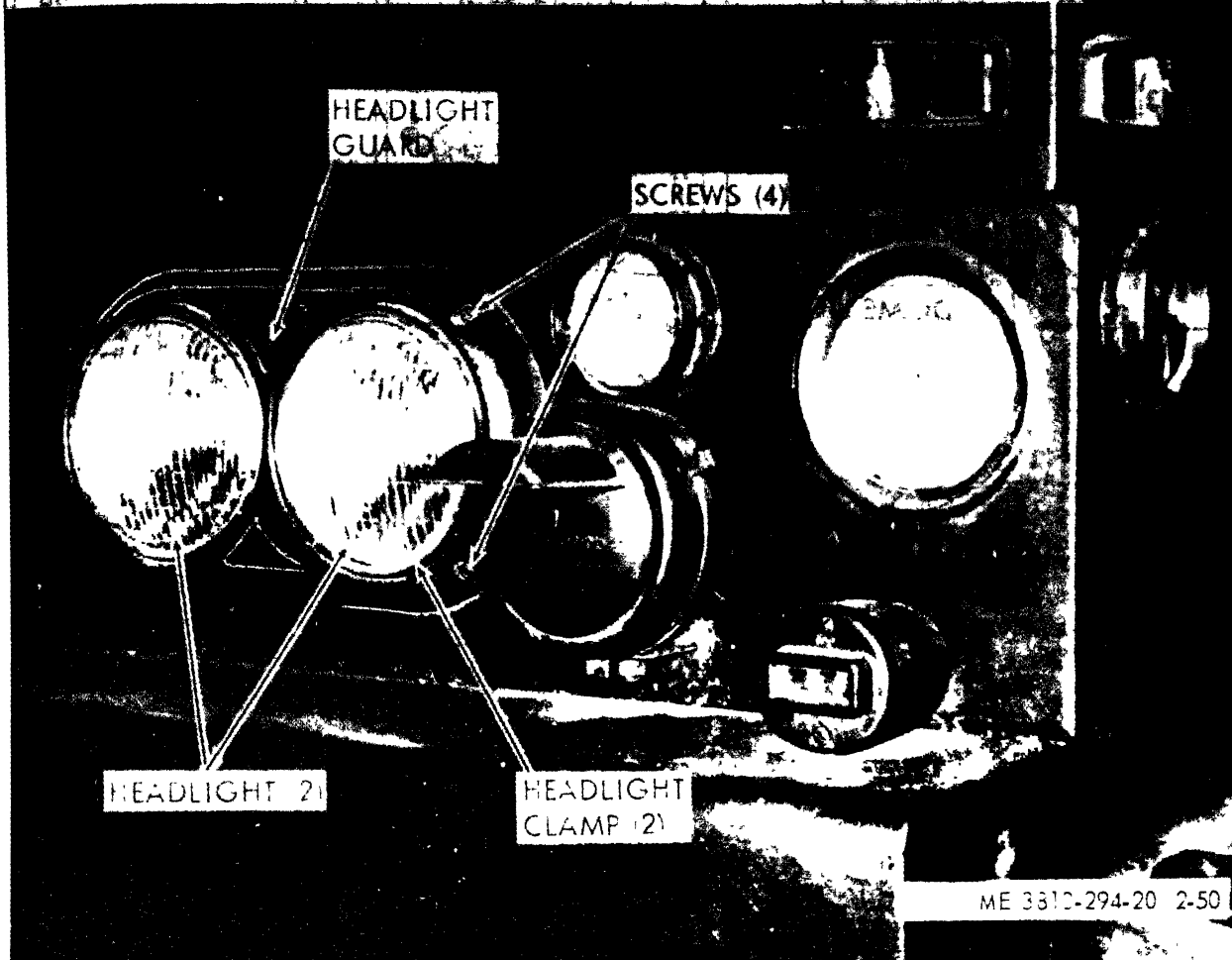


Figure 2-50. Headlights, replacement.

lights furnished with this machine, both upper and carrier positions, is illustrated in figure 2-51. Refer to figure 2-51 and remove and replace any defective light component.

d. Repair. Refer to the schematic diagram of the upper wiring, figure 1-4, to isolate wiring problems. Refer to paragraph 2-50 for the method to be used for wiring harness repair.

2-52. Slave Cable Receptacles and Cables

a. General. Slave cable receptacles are provided for recharging batteries from an external

power source. They are provided with covers to prevent dirt and moisture from entering.

b. Replacement. Refer to figure 2-52 and remove and replace a faulty slave receptacle.

c. Slave Cables. Cables must be kept clean and must be inspected before each use to be sure they are not cut, worn, or damaged. A faulty cable could lead to short circuits which could damage the crane and the power source to which the cables are connected.

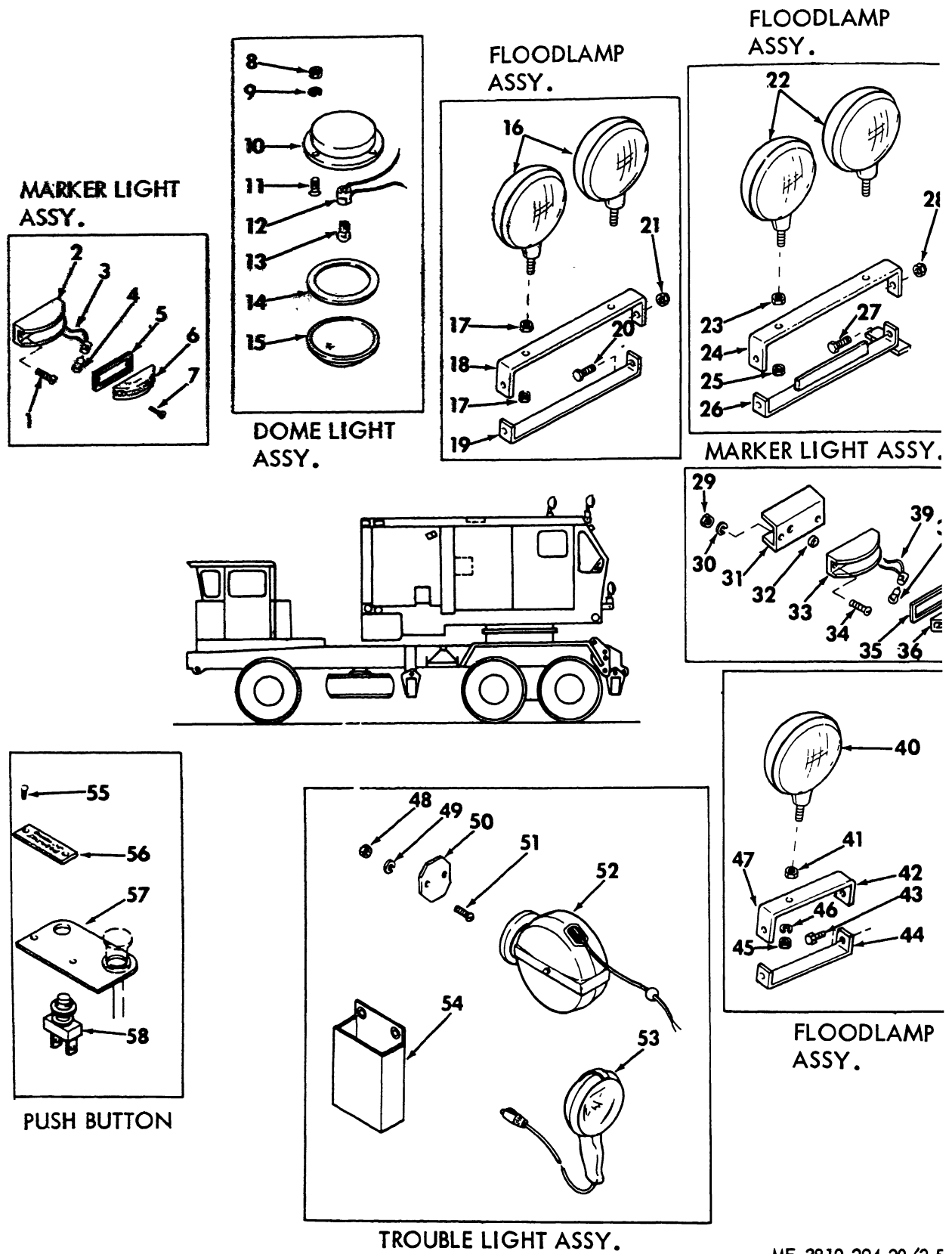


Figure 2-51. Marker lights, dome lights, flood lights, and trouble lights, removal and replacement.

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- | | | |
|---------------|----------------|--------------------|
| 1. Screw | 21. Nut | 41. Nut |
| 2. Bracket | 22. Floodlamp | 42. Bracket |
| 3. Socket | 23. Nut | 43. Screw |
| 4. Lamp | 24. Bracket | 44. Bracket |
| 5. Gasket | 25. Nut | 45. Nut |
| 6. Lens | 26. Bracket | 46. Lockwasher |
| 7. Screw | 27. Screw | 47. Bracket |
| 8. Nut | 28. Nut | 48. Nut |
| 9. Lockwasher | 29. Nut | 49. Lockwasher |
| 0. Base | 30. Lockwasher | 50. Plate |
| 1. Screw | 31. Bracket | 51. Screw |
| 2. Socket | 32. Washer | 52. Reel assembly |
| 3. Lamp | 33. Bracket | 53. Lamp assembly |
| 4. Ring | 34. Screw | 54. Lamp container |
| 5. Lens | 35. Gasket | 55. Screw |
| 6. Floodlamp | 36. Lens | 56. Plate |
| 7. Nut | 37. Screw | 57. Bracket |
| 8. Bracket | 38. Bulb | 58. Pushbutton |
| 9. Bracket | 39. Socket | |
| 20. Screw | 40. Floodlamp | |

Figure 2-51—Continued.

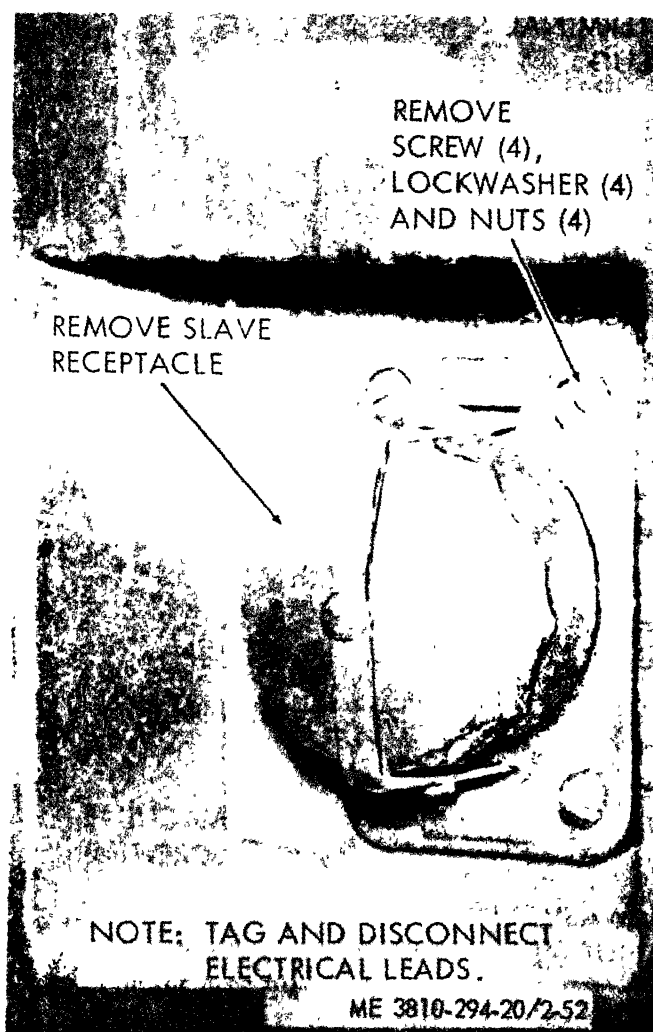


Figure 2-52. Slave receptacle, replacement.

2-53. Batteries

a. *General.* The batteries provide power for starting the engine, after which the alternator supplies required electrical power.

b. *Test.* Test the batteries with a hydrometer. If the specific gravity reads below 1.225, recharge the batteries. Retest with a hydrometer after charging. A fully charged battery should test between 1.280 and 1.300. Replace a battery that will not take or hold a charge. The difference in specific gravity between any two cells must not exceed 0.025. Remove battery filler caps and add distilled water to 3/8-inch above plates before recharging. Refer to tables 2-3 and 2-4.

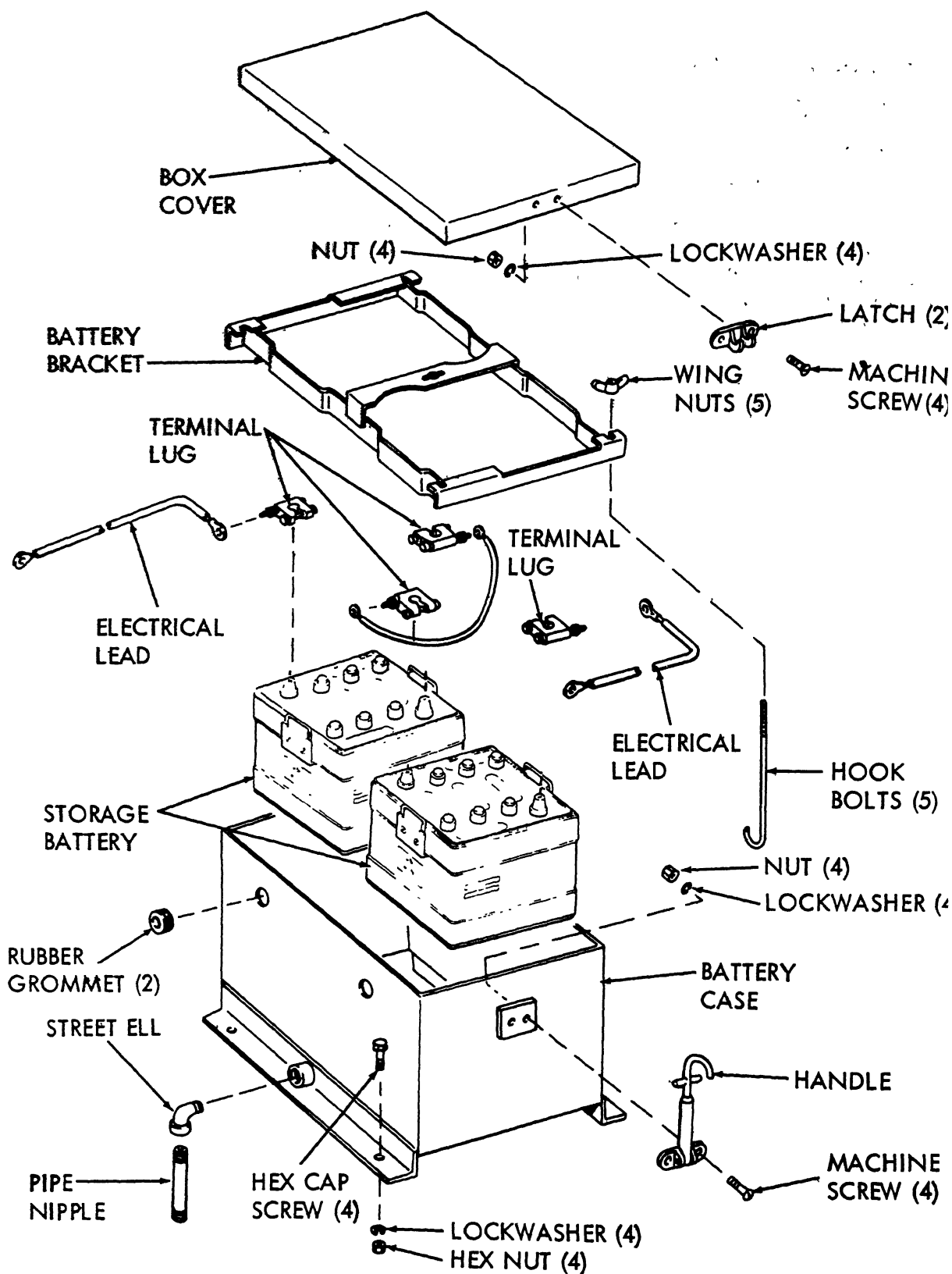
Table 2-3. Battery Condition (Corrected to 80° F).

Specific gravity	Battery condition
1.280	Fully charged.
1.250	75% charged.
1.220	50% charged.
1.190	25% charged.
1.160	Almost discharged.
1.130	Discharged.

Table 2-4. Electrolyte Freezing Points

Specific gravity	Temperature ° F.
1.280	- 90
1.250	- 62
1.200	- 16
1.150	+ 5
1.100	+19

c. *Replacement.* Refer to figure 2-53 and replace faulty batteries or battery box components.



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Figure 2-53. Batteries and battery box, replacement.

Section XIV. MAINTENANCE OF INSTRUMENT CONTROL ASSEMBLY

2-54. Engine Control Panel Replacement

a. General. Figure 2-54 illustrates the various control gages and instruments located on the control panel. Refer to TM 5-3810-294-10 for a description of the function of each.

b. Replacement. Refer to figure 2-54 and replace any damaged or faulty component of the control panel. Note that the panel is removable as a unit by removing the row of attaching fasteners around the edge of the panel.

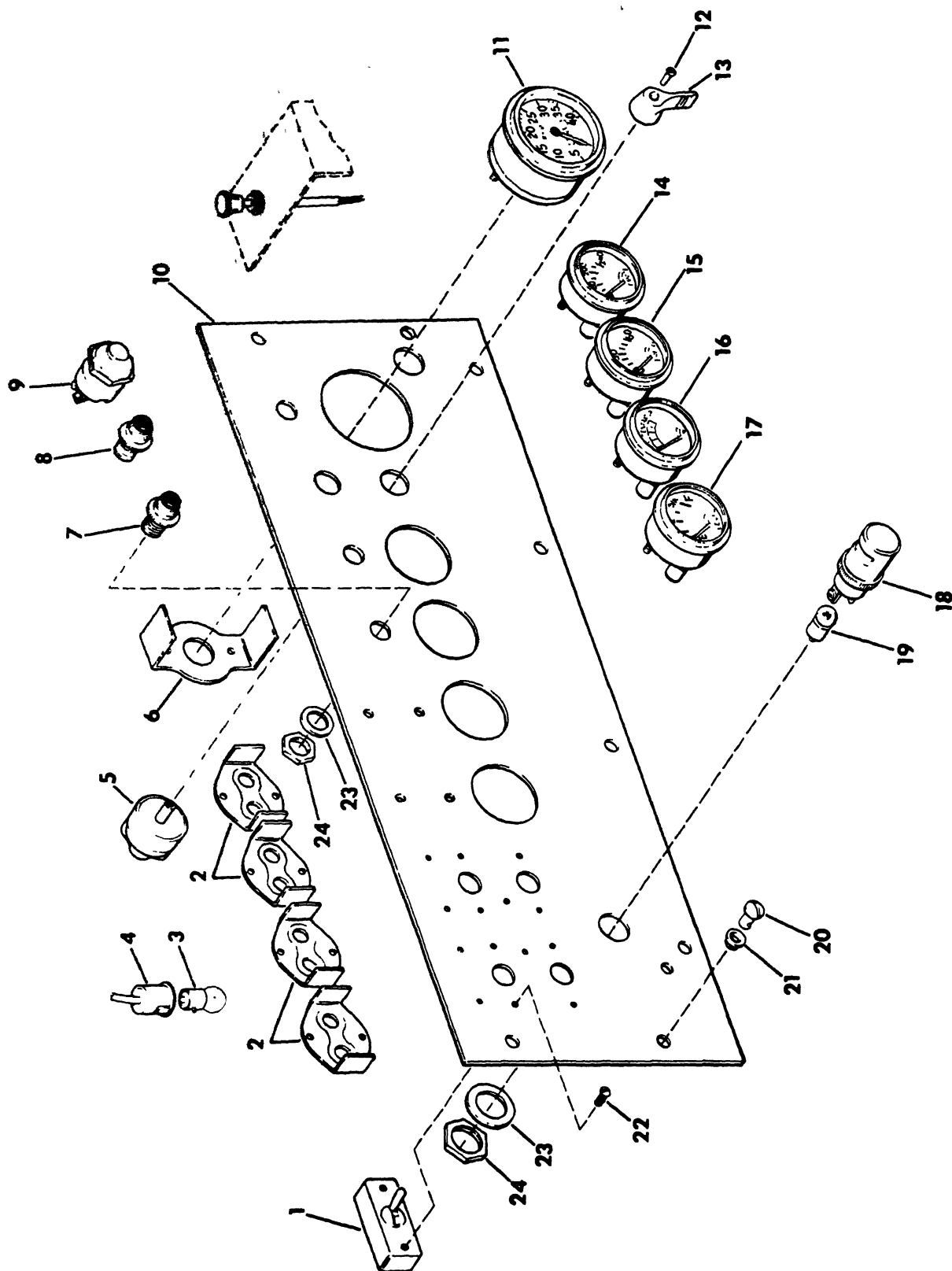
CAUTION

Disconnect battery cables before working on the control panel.

2-55. Switches and Wiring, Replacement and Repair

a. Refer to the schematic wiring diagram of the upper wiring, figure 1-4, to isolate wiring problems.

b. Refer to paragraph 2-50 for the method to be used for wiring replacement or repair.

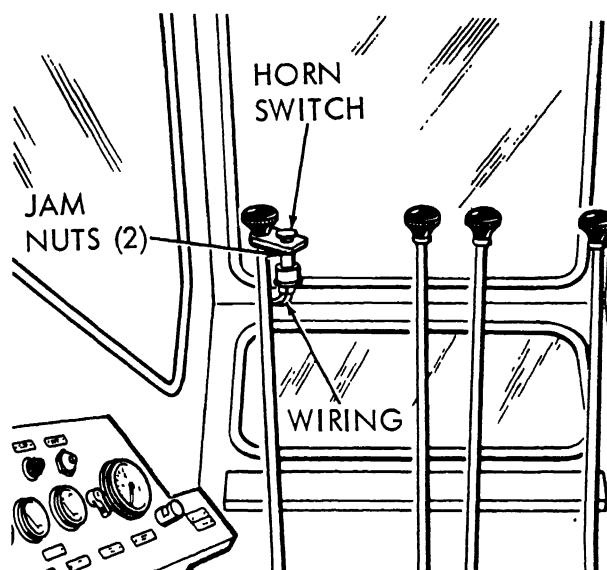


Section XV. MAINTENANCE OF HORN, WIRING, AND TACHOMETER DRIVE

2-56. Horn Replacement

a. General. The horn is used to warn personnel of machine movement which might endanger their safety.

b. Replacement. Refer to figure 2-55 and replace a defective horn switch. Refer to figure 1-4 for the upper machinery wiring diagram.



- STEP 1. REMOVE JAM NUTS
- STEP 2. REMOVE HORN SWITCH.
- STEP 3. REMOVE WIRING.

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Figure 2-55. Horn switch and wiring, replacement.

2-57. Horn Wiring, Replacement and Repair

Refer to paragraph 2-50 for the method of replacing or repairing the horn wiring.

2-58. Tachometer and Drive

a. General. The tachometer is mounted on the engine control panel (fig. 2-54). It is cable driven from the tachometer drive (fig. 2-56).

b. Tachometer Removal and Replacement.

(1) Refer to figure 2-56 and disconnect the tachometer drive cable from the tachometer. Remove the tachometer from the control panel.

(2) Install tachometer on control panel and connect drive cable.



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Figure 2-56. Tachometer drive cable.

Section XVI. MAINTENANCE OF EXHAUST MUFFLER AND PIPES

2-59. General

The exhaust muffler and pipes are illustrated in figure 2-57. Maintenance consists of inspection, removal, and replacement of defective muffler and pipes.

2-60. Exhaust Muffler and Pipes

a. Inspection. Inspect the muffler and exhaust pipes for cracks, breaks, or signs of deterioration.

b. Removal.

(1) Stop the engine and allow muffler and pipes to cool.

(2) Refer to figure 2-57 and remove nuts and bolts holding the guard to the supports.

(3) Remove nuts, lockwashers, and muffler clamps, and remove the muffler and exhaust elbow from the exhaust pipe.

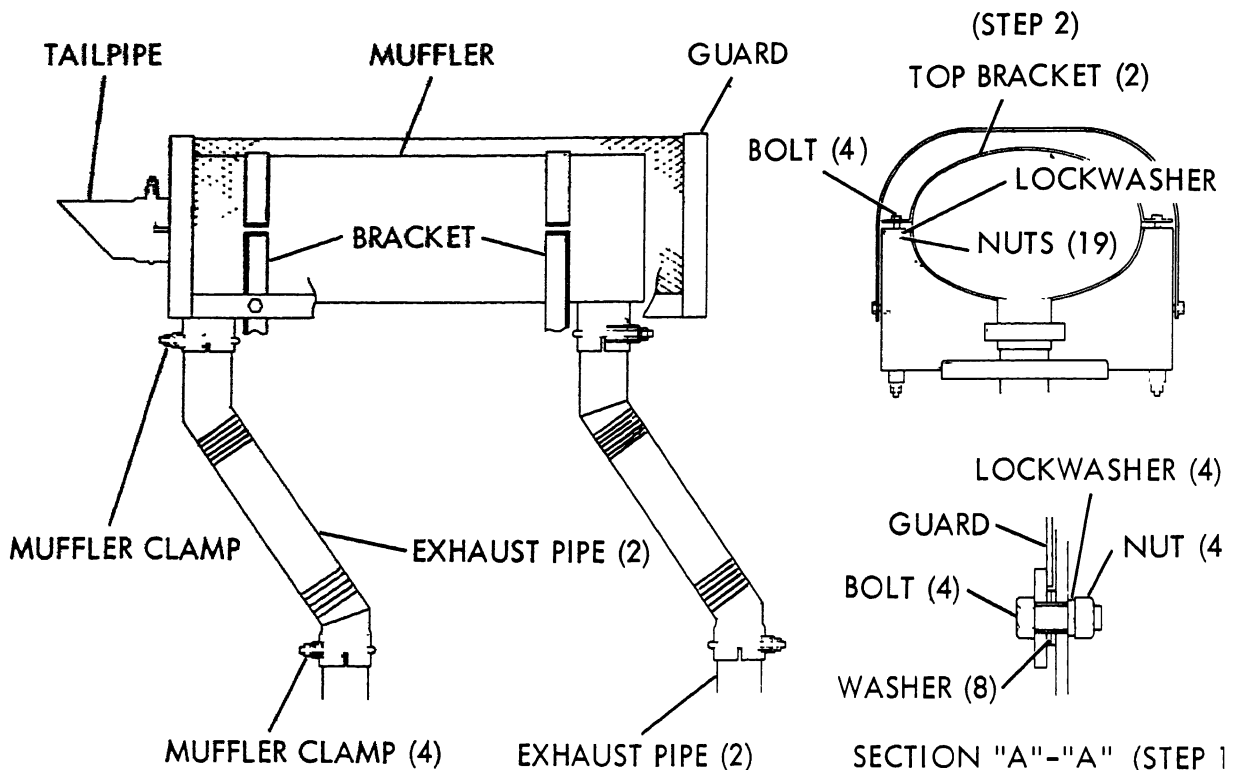
(4) Remove capscrews, nuts, and lockwashers from the base of the exhaust pipe, and remove exhaust pipe and gasket.

c. Replacement.

(1) Install a new gasket on exhaust manifold, place exhaust pipe on exhaust manifold, and secure with cap screws, nuts, and lockwashers.

(2) Install exhaust elbow in muffler install muffler on exhaust pipe. Install muffler clamps.

(3) Install the guard on the supports.



STEP 1. SEE SECTION A-A AND REMOVE FOUR BOLTS, EIGHT WASHERS, FOUR LOCKWASHERS, FOUR NUTS AND REMOVE GUARD.

STEP 2. REMOVE FOUR BOLTS, LOCKWASHERS, AND NUTS. REMOVE BRACKETS.

STEP 3. REMOVE FOUR CLAMPS. REMOVE MUFFLER (1) AND EXHAUST PIPES.

ME 3810-294-20/2.

Figure 2-57. Exhaust muffler and piping, removal.

Section XVII. MAINTENANCE OF CAB ASSEMBLY

2-61. Doors, Replacement

a. Removal. Refer to figure 2-58 and remove a damaged door.

b. Installation.

(1) Place door in position and install angle and rear panel.

(2) Install bolts, lockwashers, and nuts.

2-62. Glass

a. Inspection. Inspect glass in cab asser for breakage. Check weatherstripping for s of deterioration.

b. Removal. The only reason for remo glass is when the glass is broken. Break out remaining glass, being careful to avoid pers

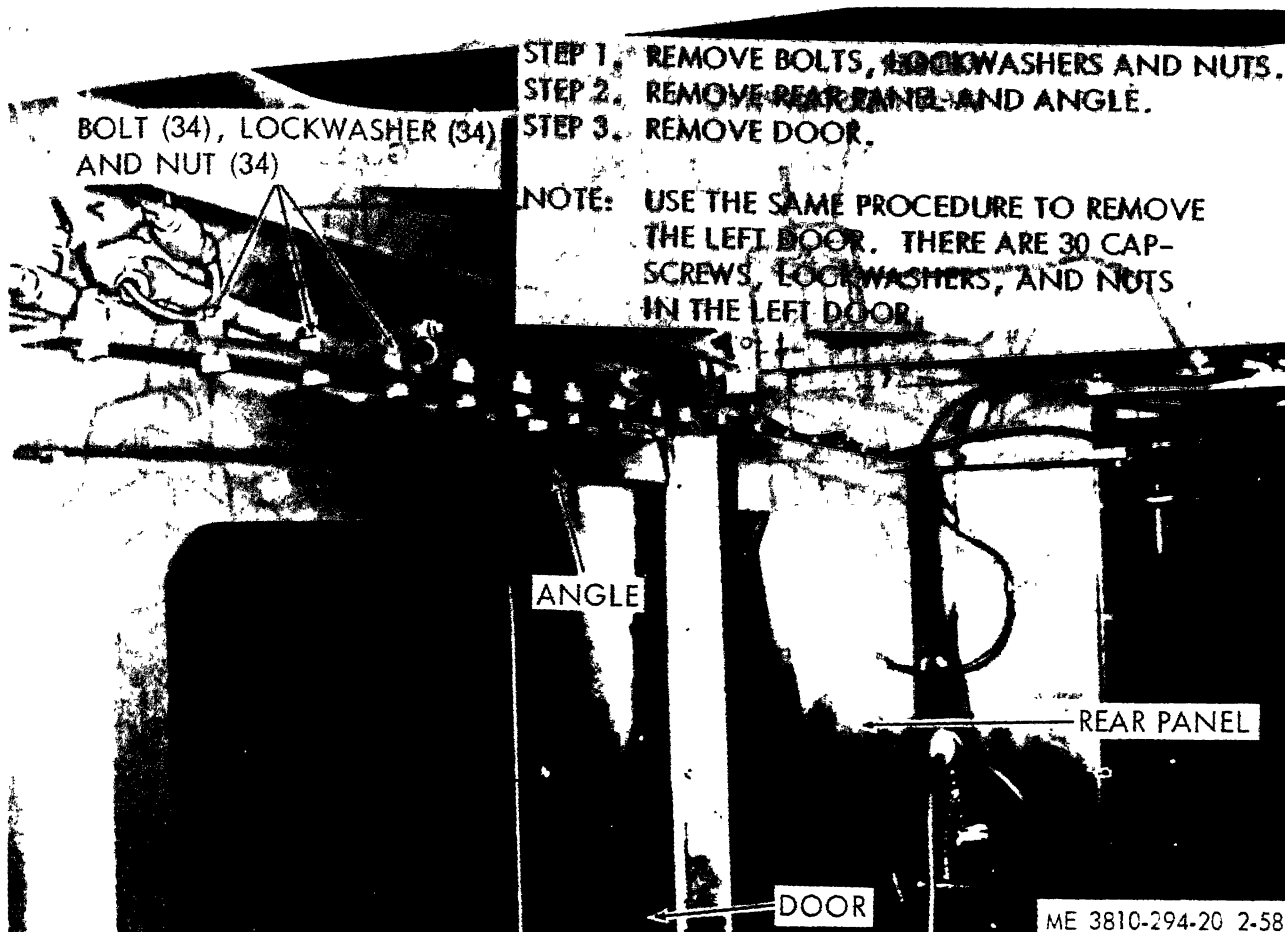


Figure 2-58. Cab door assembly, removal.

injury. Place masking tape on the piece of glass to be broken out to prevent flying glass. Remove the weatherstripping around the glass.

c. Installation.

(1) Start the rubber weatherstripping as shown in figure 2-59. Go all the way around the window and force the ends into place, touching each other.

(2) Install the glass in one of the lower corners of the new weatherstrip.

(3) Moisten the weatherstrip with soapy water.

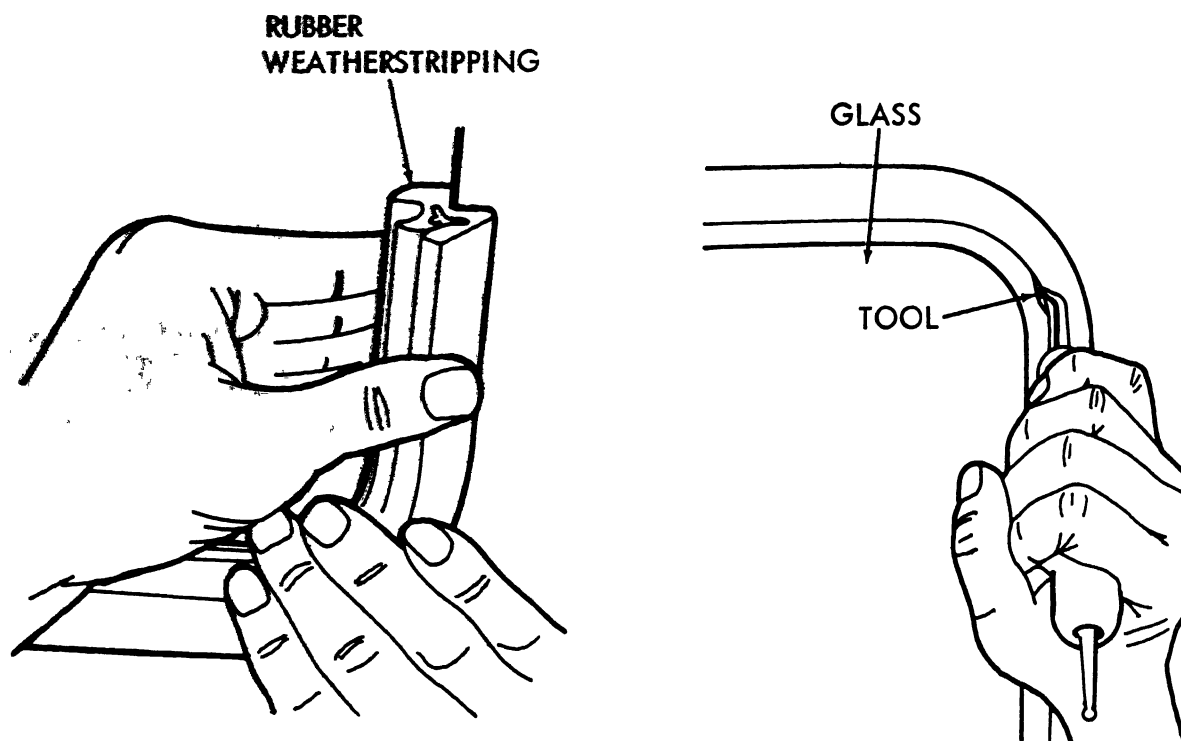
(4) Insert a suitable locking tool similar to the one illustrated in figure 2-59 and pull it around the complete weatherstrip to lock the glass in place.

NOTE

Do not begin the locking operation at the butt joint of the weatherstrip. Be sure to avoid excessive force.

2-63. Operators Seat

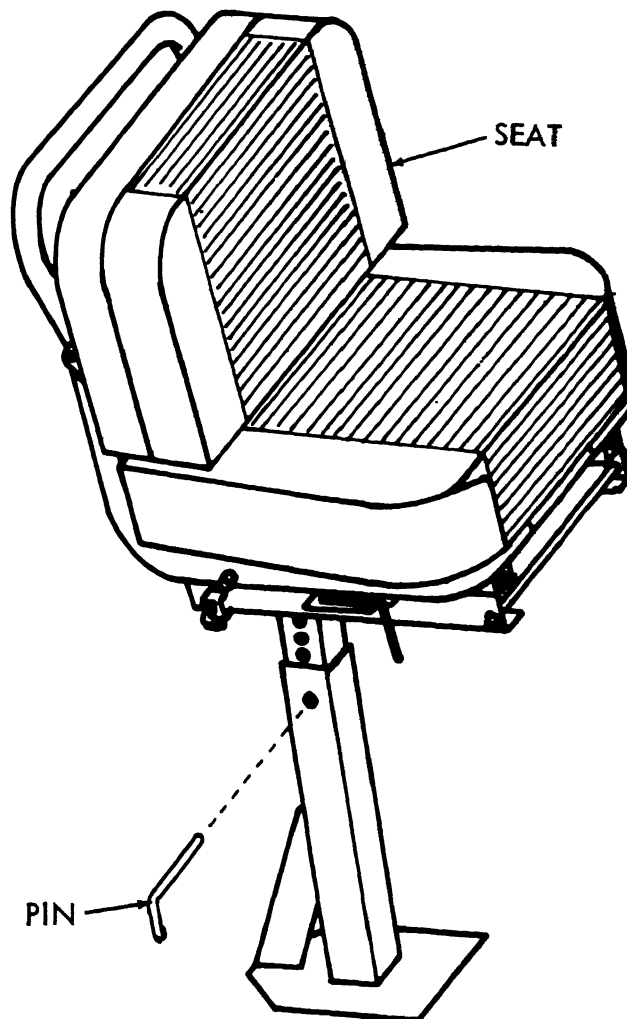
Refer to figure 2-60 and remove and replace the operator's seat (Stand).



- STEP 1. INSTALL RUBBER WEATHERSTRIPPING.
- STEP 2. INSTALL GLASS.
- STEP 3. LOCK WEATHERSTRIPPING, USING SUITABLE TOOL.

ME 3810-294-20/2.

Figure 2-59. Window glass, installation.



STEP 1. REMOVE PIN.
STEP 2. REMOVE SEAT.

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Figure 2-60. Operator's seat, removal.

Section XVIII. MAINTENANCE OF GANTRY ASSEMBLY

2-64. General

The gantry provides the anchor for items required to support the boom.

2-65. Gantry Assembly

a. Inspection. Visually inspect the gantry for evidence of cracks, bends, or other damage. Check the condition of gantry sheaves, paying careful attention to cracks or excessive grooving.

Make sure that points which require lubrication have not been missed.

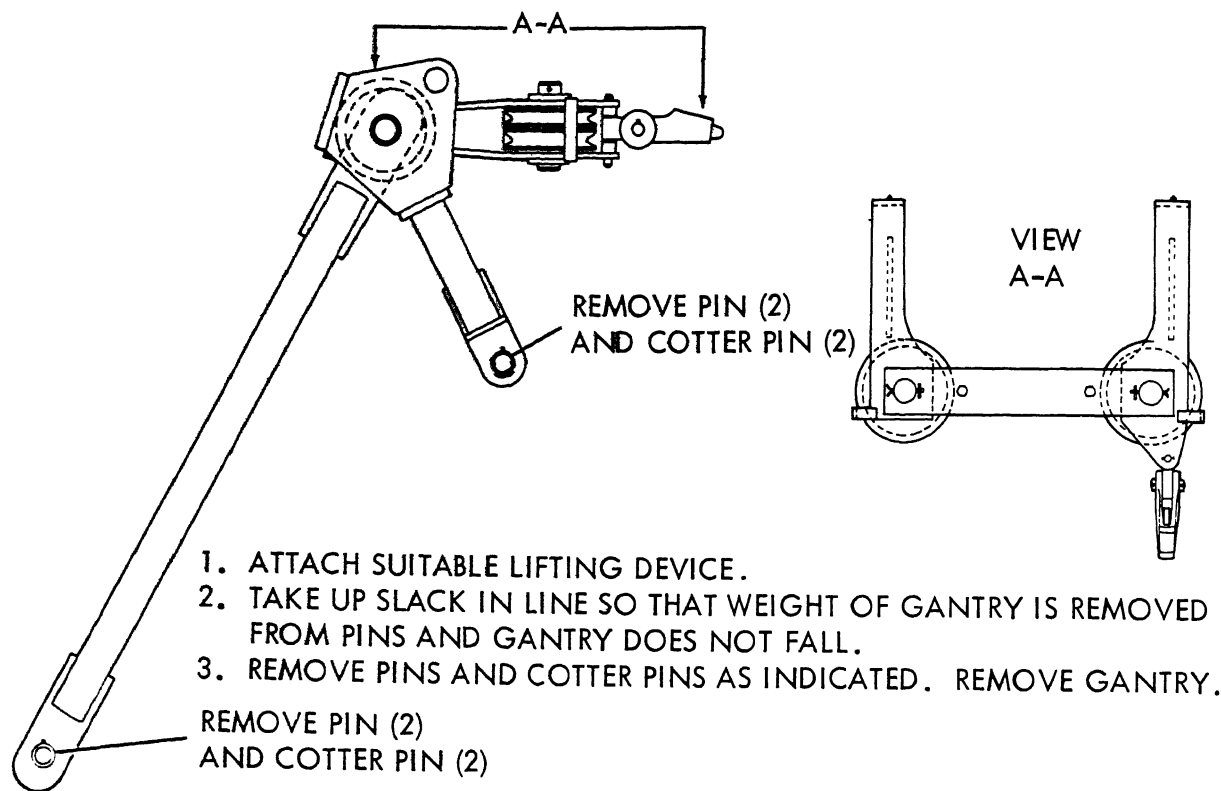
b. Removal.

(1) Refer to applicable paragraph (2-4 through 2-9) and remove the front end attachment.

(2) Remove boom backstops (para 2-47).

(3) Refer to figure 2-68 and remove sheet metal as required.

(4) Refer to figure 2-61 and remove the gantry assembly.



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Figure 2-61. Gantry assembly removal.

c. Installation.

- (1) Refer to figure 2-61 and install pins and cotter pins removed during gantry removal.
- (2) Refer to figure 2-68 and replace sheet

metal as required.

- (3) Install backstops (para 2-47).
- (4) Install applicable front end attachm (para 2-4 through 2-9).

Section XIX. MAINTENANCE OF ACCESSORY ITEMS

2-66. Heater and Switch

a. General. The upper heater is a hot water-air blower type. Hot water from the engine radiator is piped to the heater through the input line shown in figure 2-61A where it passes through metal coils. This hot water serves as the means of heating cold air drawn by an electric motor driven fan. The heated air then passes through the heater flexible hose to the sheet metal heater duct located on the right side of the operator's cab wall. The heater switch is located on the control panel (fig. 2-54).

b. Heater Replacement (fig. 2-61A)

- (1) Open the petcock on side of heater and drain coolant below level of heater. Open coolant drains to assist in draining coolant.

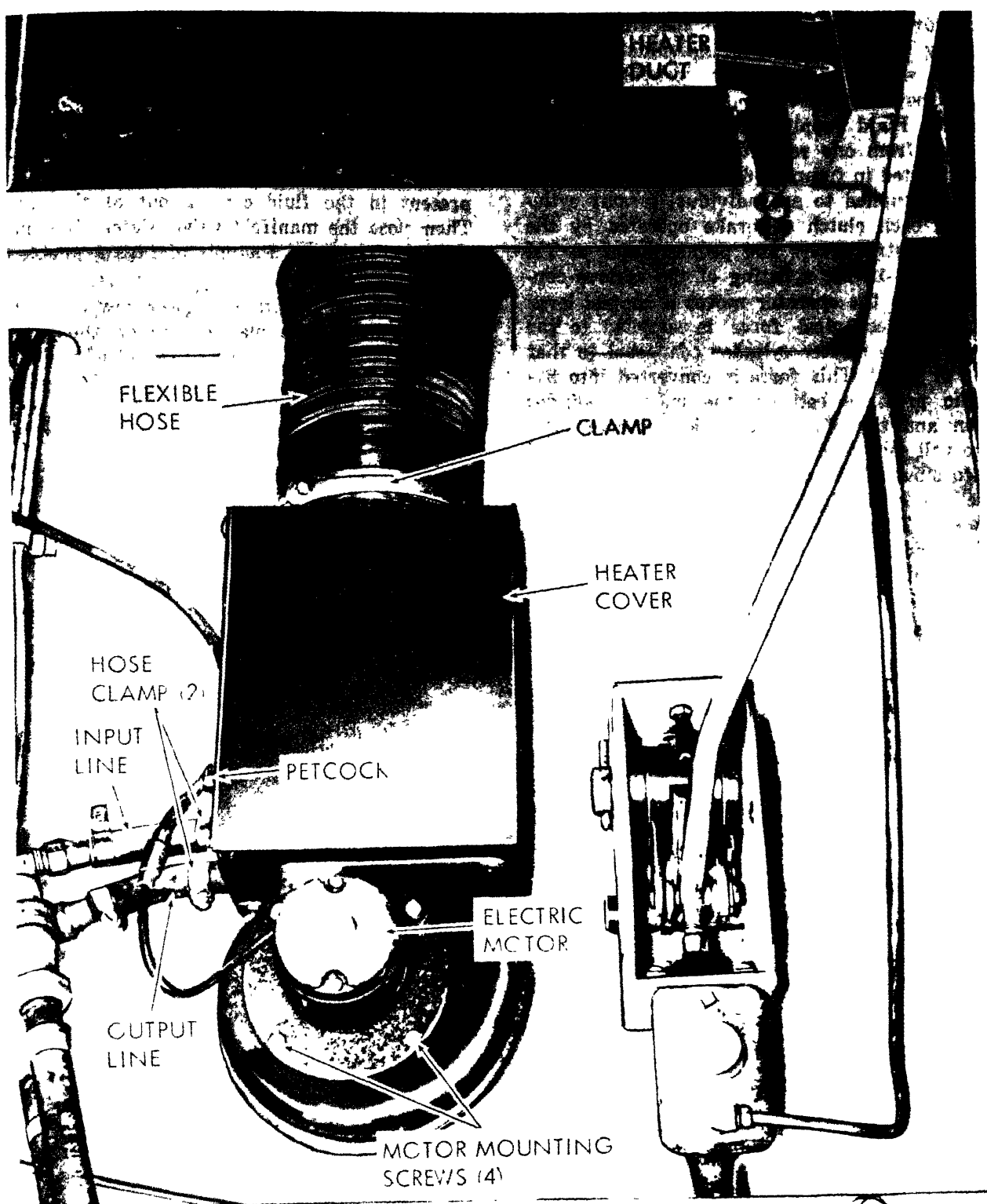
- (2) Remove flexible hose clamp.
- (3) Disconnect input hose and output by removing hose clamps.
- (4) Remove the heater cover by removing the four capscrews which secure it to the plate.

2-67. Defroster Hose Replacement

Refer to figure 2-61A and replace a defroster hose.

2-68. Wiring Replacement

Refer to the schematic wiring diagram, figure 4, and to paragraph 2-49, and replace defroster wiring.



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Figure 2-61A. Heater, replacement.

Section XX. MAINTENANCE OF HYDRAULIC SYSTEM

2-69. General

The hydraulic system for this machine consists basically of a number of individual systems, each of which is designed to provide the hydraulic power required to perform one specific function. Fluid supply for the entire system is supplied from one reservoir and one manifold, as illustrated in figure 2-62. From the manifold, fluid is supplied to an individual master cylinder for each clutch or brake operated by the various control levers and pedals. Refer to TM 5-3810-294-10 for a listing of the various controls. When the operator moves a control lever or pedal, mechanical force is supplied to the piston of the master cylinder connected to that lever or pedal. This force is converted into hydraulic pressure between the master cylinder piston and the clutch or brake cylinder. The force will cause the clutch or brake cylinder piston to move outward. This movement forces the clutch or brake band cylinder piston to move outward. This movement forces the clutch or brake band or shoes to contact the drum, engaging the clutch or brake.

2-70. Hose, Fittings, and Tubing

a. *General.* Visually inspect hydraulic hose and tubing for leaks, cracks or breaks. Tighten any loose fittings, hose, or tube which is causing the hydraulic system to leak. Be sure to wipe up any spilled hydraulic fluid. Hydraulic fluid is a lubricant, and if spilled on brake or clutch lining it will cause otherwise serviceable brake or clutch linings to slip.

b. *Replacement.* Close the shut-off valve at the hydraulic reservoir shown in figure 2-63. Then, refer to figure 2-64(1) and (2); remove and replace any worn or damaged hydraulic hose, fitting or tube.

NOTE

Always cap or plug each end of the hose or fitting when a piece has been removed, to prevent dirt from entering the hydraulic system and to prevent the loss of unnecessary amounts of hydraulic fluid. Refill the hydraulic reservoir and bleed the system as described in the following, when the damaged item has been replaced.

c. *Bleeding.* When air is present in the hydraulic system, the controls are "spongy" and do not operate to hold the brakes and clutches as firmly as when air is absent. All air must be removed before the controls will operate properly. Bleed the system as follows:

NOTE

Containers must be perfectly clean and no mineral oil can be used in the hydraulic system.

(1) Fill the reservoir (fig. 2-63) with proper fluid and check the level frequently during the following steps. Keep the reservoir full.

(2) Open the manifold valve (fig. 2-64) and allow fluid to flow until no bubbles present in the fluid coming out of the valve. Then close the manifold valve. Catch fluid in a clean jar and have a supply of rags available to catch leakage fluid.

(3) Starting with the lower row of master cylinders, open the bleeder cap on the top of each master cylinder in turn, and bleed the fluid until no air is visible in the fluid. Then close the bleeder cap while solid, bubble-free fluid is being expelled.

(4) Attach a bleeder hose, which may be a length of any clear plastic hose, to the bleeder valve of the lowest clutch or brake cylinder to be bled. Refer to figure 2-65. Bleed the fluid from each of the hydraulic cylinders on the machine, beginning with the lowest cylinder and working toward the highest cylinder. Keep the hose submerged in fluid at the bottom of the jar to prevent air from re-entering the system.

NOTE

Cylinder bleed fittings must be at their highest point of travel. They may be positioned by "tapping" the engine start pushbutton.

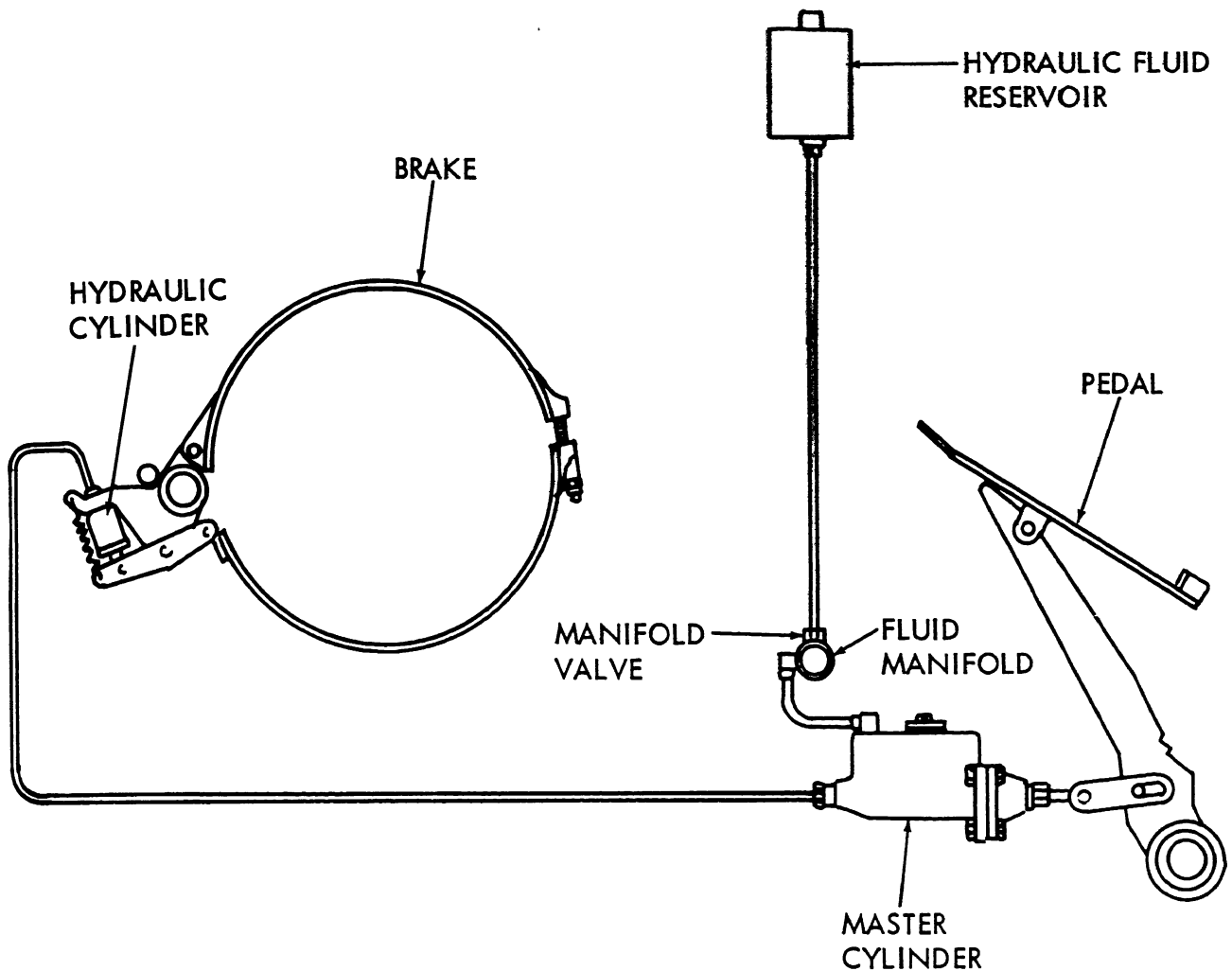
(5) Work each of the controls slowly and note the action of the brake or clutch. If a control still feels "spongy", slight pressure may be applied to the operating lever or pedal to assist in expelling more fluid from the cylinder. Be sure to close the bleed screw before the lever or pedal reaches the end of its stroke or air will be sucked into the system through the bleed screw.

2-71. Manifold and/or Control Valves

a. *Master Cylinders.*

(1) *General.* Master cylinders convert mechanical motion of an operating lever or pedal into hydraulic force, which actuates the appropriate hydraulic cylinder.

(2) *Replacement.* Refer to figure 2-66 to remove a faulty master cylinder; install new master cylinder by reversing the step procedure on illustration. Use the same procedure for each master cylinder.



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Figure 2-62. Hydraulic system, schematic diagram.

b. Hydraulic Cylinder (Brake or Clutch).

(1) *General.* Clutch and brake hydraulic cylinders are identical. Start engine and position adjusting bolts in the desired position by intermittently engaging engine clutch.

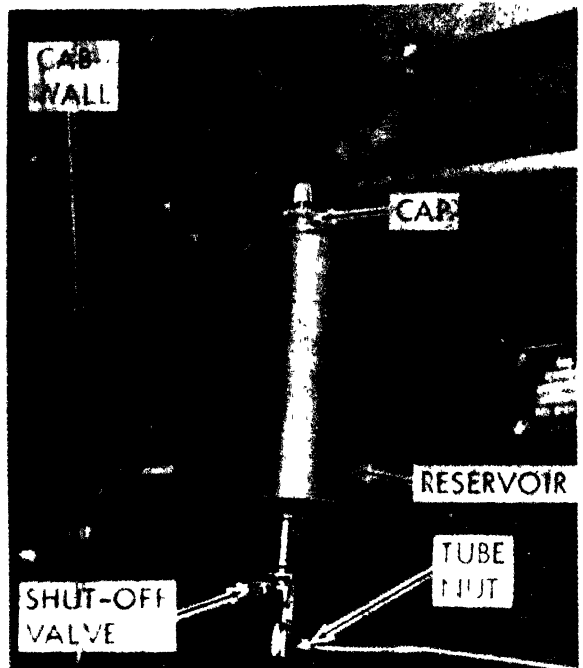
(2) *Replacement.* Close the hydraulic reservoir shutoff valve shown in figure 2-63. Refer to figure 2-67 and replace a hydraulic cylinder. Use same procedure for each hydraulic brake and clutch cylinder.

2-72. Hydraulic Fluid Reservoir

a. *General.* The hydraulic fluid reservoir provides the storage space required for hydraulic fluid used in the crane control system. It also allows air trapped in the lines from the control stand beneath the operator's levers to vent from the system. It must be kept filled to the full mark at all times.

b. *Service.* Service consists of keeping the hydraulic reservoir full of clean fluid of the type specified in the lubrication chart.

c. *Replacement.* Refer to figure 2-63 and remove and replace the hydraulic fluid reservoir.



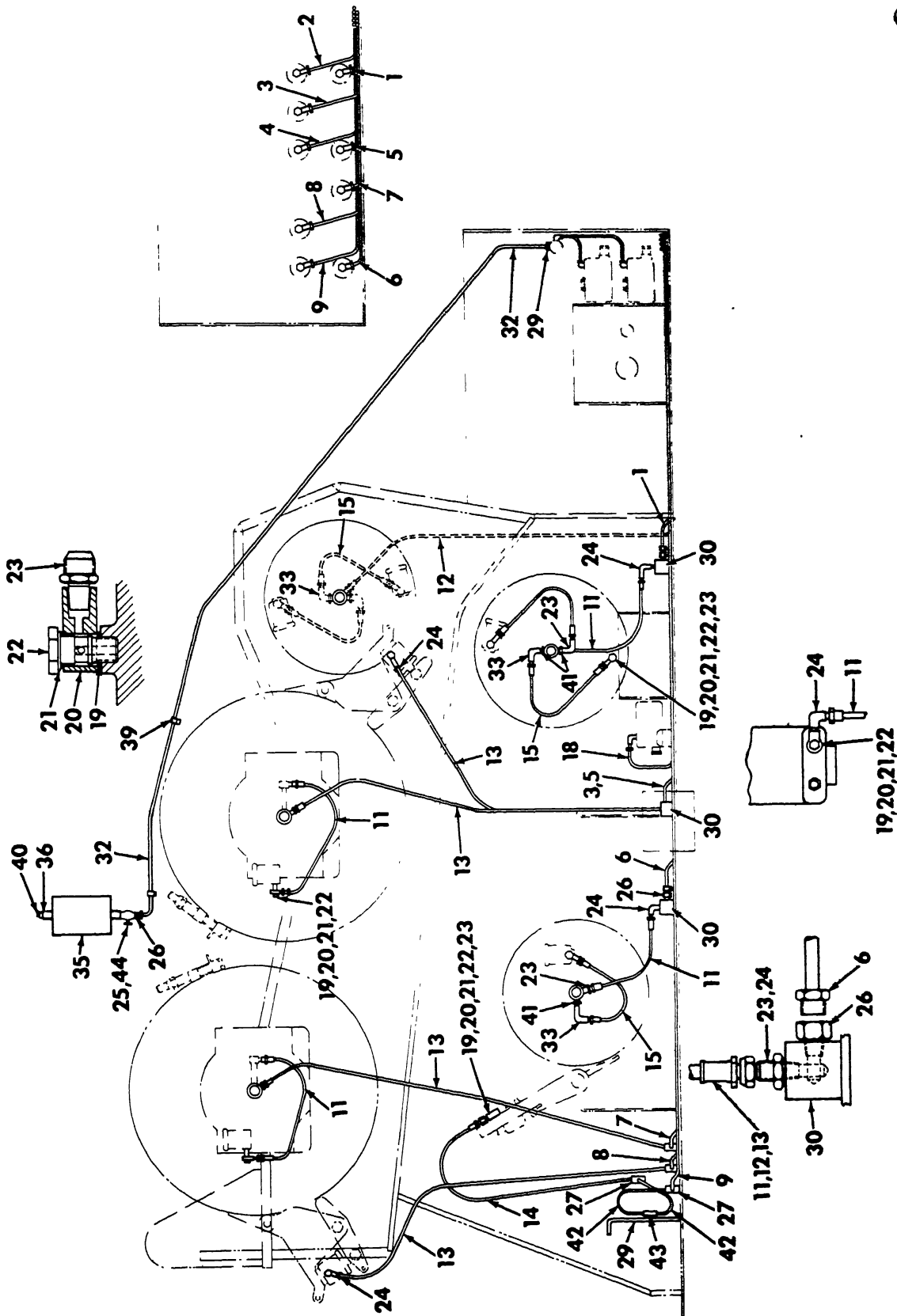
STEP 1. TO SERVICE, REMOVE CAP AND FILL TO ONE INCH BENEATH TOP COVER WITH ALL CONTROL LEVERS IN CENTERED POSITION. DO NOT OVER FILL. USE FLUID LISTED IN CURRENT L.L.

STEP 2. TO REMOVE, CLOSE SHUT-OFF VALVE, LOOSEN TUBE NUT, CAP TUBE, AND REMOVE TUBE AND SPRING FROM THE LINE.

2-70c

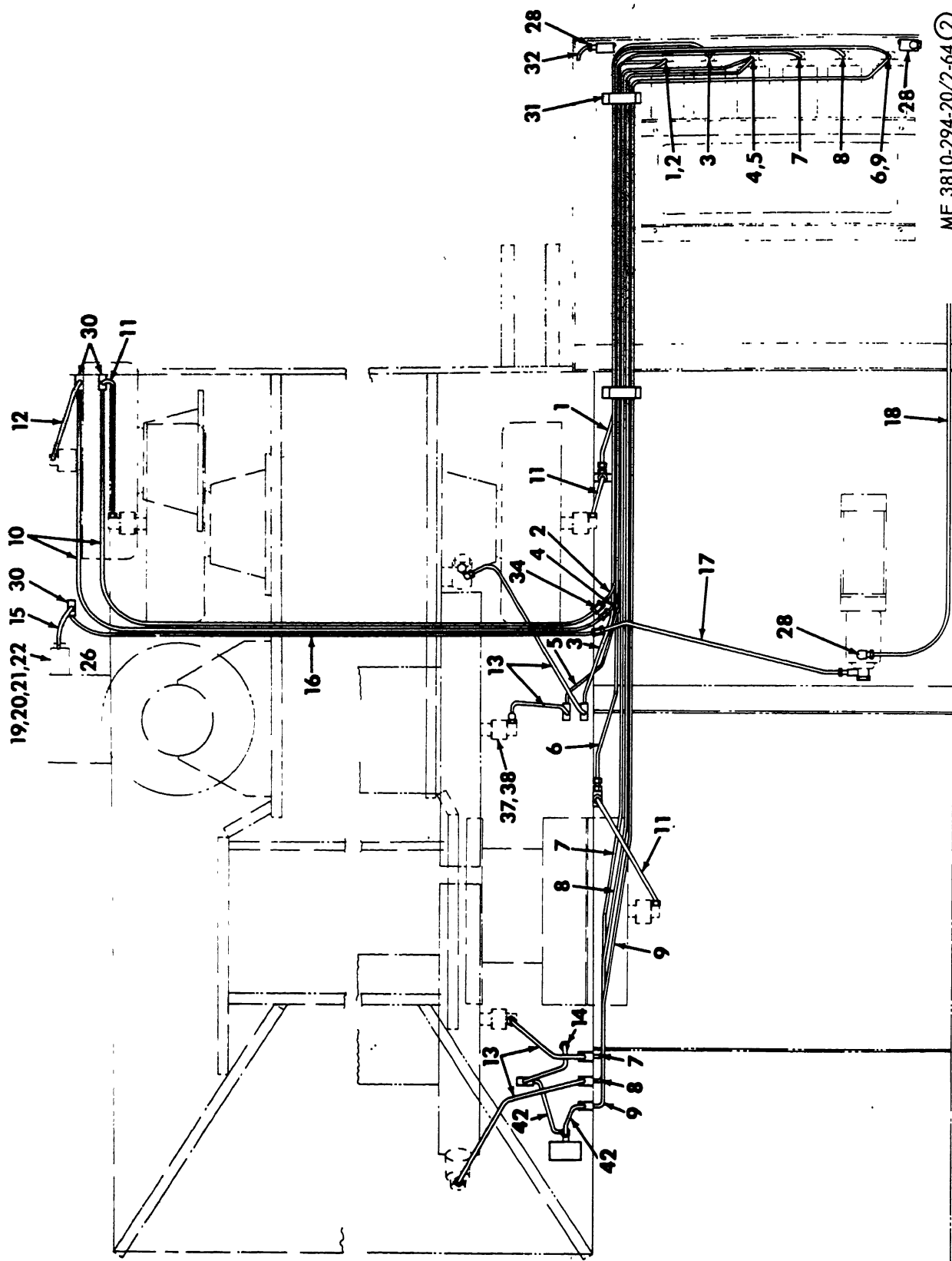
ME 310 294.20 2-63

Figure 2-63. Hydraulic fluid reservoir, service and replacement.



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Figure 2-64. Hydraulic hoses, fittings, and tubing, replacement. (Sheet 1 of 2).



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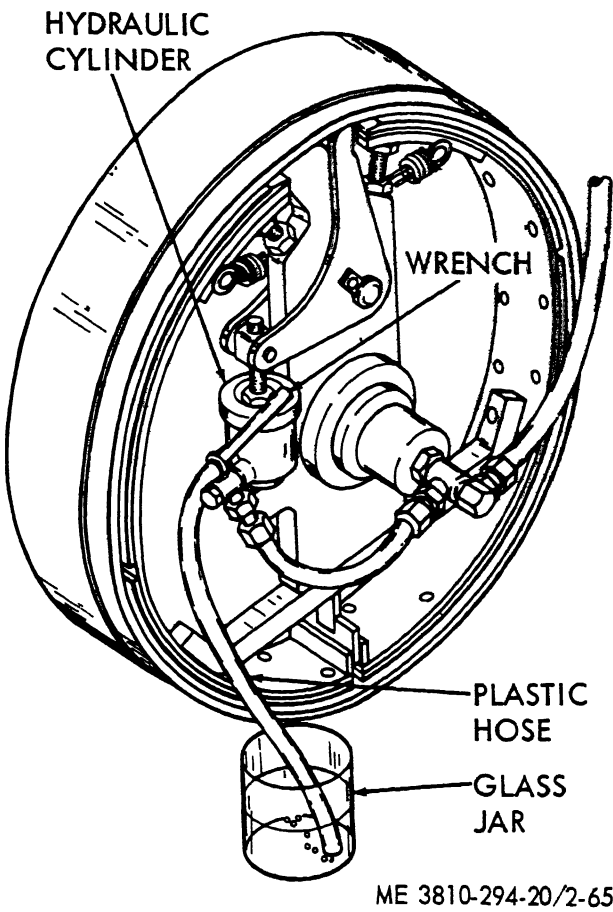
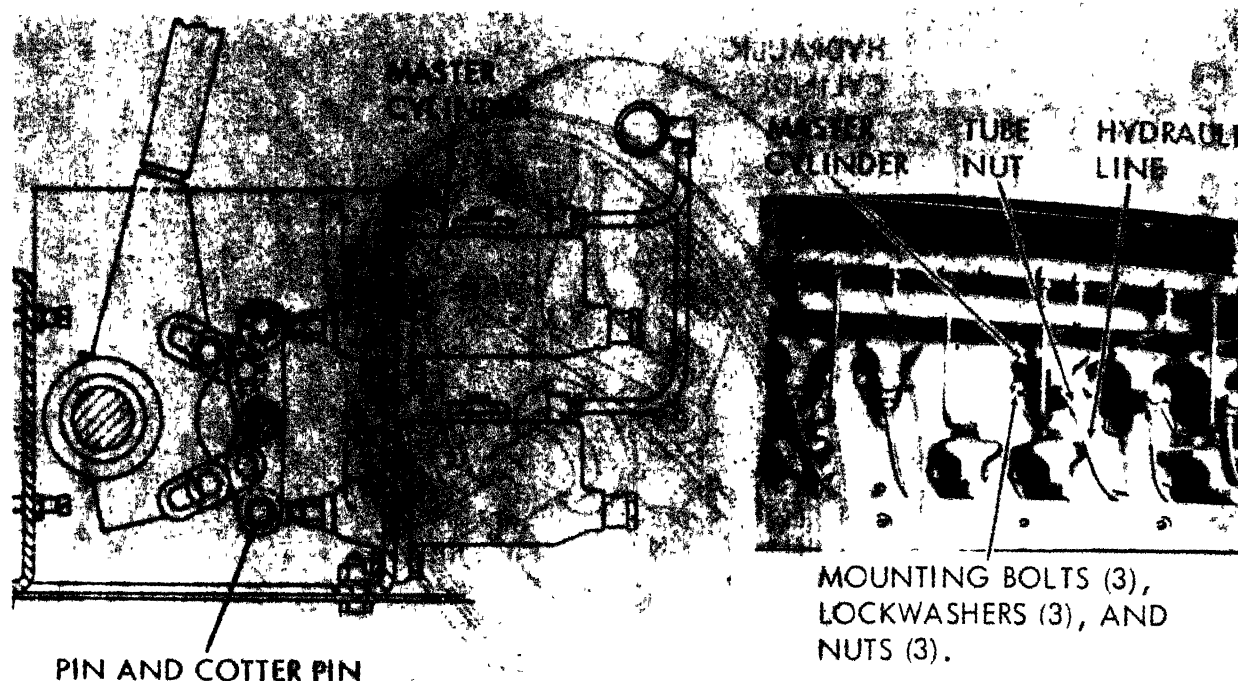


Figure 2-65. Hydraulic cylinder, bleeding procedure.



- STEP 1. CLOSE HYDRAULIC SHUT-OFF VALVE (FIGURE 2-63).
- STEP 2. REMOVE FLOOR PLATE COVERING MASTER CYLINDERS
- STEP 3. REMOVE PLATE AS SHOWN ABOVE.
- STEP 4. REMOVE PIN AND COTTER PIN AT INSIDE CONTROL MASTER CYLINDER CONNECTION.
- STEP 5. DISCONNECT HYDRAULIC LINES AT TUBE NUTS AND IMMEDIATELY PLUG LINES
- STEP 6. REMOVE MOUNTING BOLTS, LOCKWASHERS AND NUTS, AND REMOVE MASTER CYLINDER.

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Figure 2-66. Master cylinders, replacement.



Figure 2-67. Hydraulic cylinders, replacement.

Section XXI. MAINTENANCE OF COOLING SYSTEM

2-73. General

The cooling system consists of the radiator and hoses, lines, and fittings required to conduct coolant from the engine to the radiator and back to the engine to complete the cooling circuit. Drain valves are located on the lower radiator hose connection and at the right rear of the engine block to drain the radiator and block.

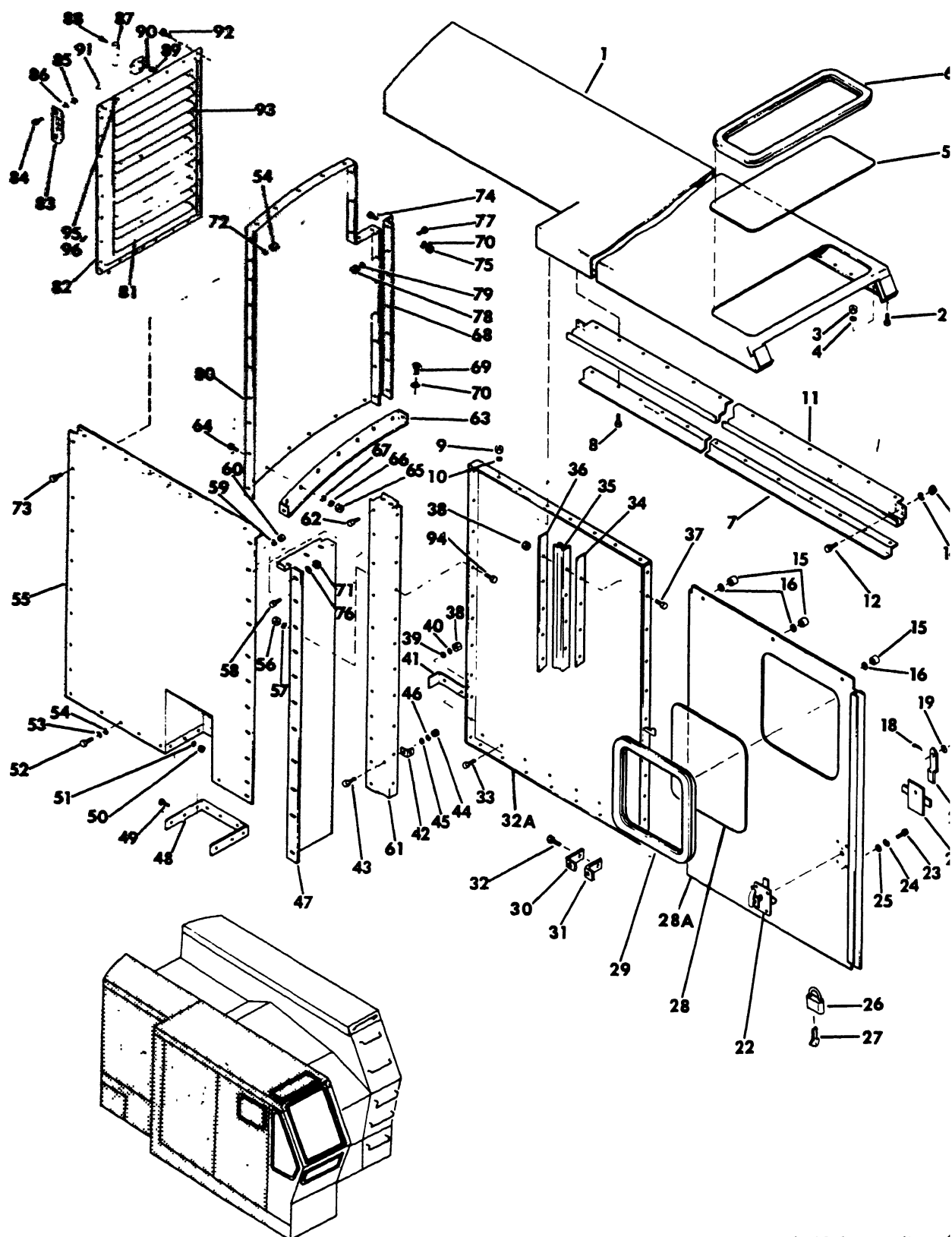
2-74. Radiator, Cap, and Hoses

a. Inspect. Visually inspect the radiator and hoses for leaks or damage.

b. Test. If a cap tester is available, test the radiator cap. The cap should retain 4 psi pressure. If cap tester is not available, and the cap is suspected of leaking, replace the cap.

c. Replacement. Before removing the radiator, open both coolant drain valves and drain the radiator and engine block. Then refer to figure 2-69 and remove and replace the radiator as follows.

(1) Refer to figure 2-68 and remove radiator shutters and sheet metal as required.



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Figure 2-68. Cab sheet metal assembly, removal and replacement, (sheet 1 of 6).

1. Canopy	32A. Panel assembly	65. Nut (9)
2. Hex capscREW (30)	33. CapscREW (8)	66. Flat washer (9)
3. Nut (30)	34. Backup strip	67. Lockwasher (9)
4. Lockwasher (30)	35. Rubber seal strap	68. Angle
5. Safety glass	36. Shim	69. CapscREW (7)
6. Weather strip	37. Machine screw (12)	70. Lockwasher (35)
7. Guide	38. Nut (8)	71. Nut (23)
8. CapscREW (17)	39. Flat washer (8)	72. Nut (18)
9. Nut (17)	40. Lockwasher (8)	73. CapscREW (18)
10. Lockwasher (17)	41. Mounting plate	74. CapscREW (28)
1. Rain gutter	42. Bracket	75. Nut (23)
2. CapscREW (8)	43. CapscREW	76. Lockwasher (23)
3. Nut (8)	44. Nut	77. CapscREW (7)
4. Lockwasher (8)	45. Flat washer	78. Nut (7)
5. Ball bearing (3)	46. Lockwasher	79. Lockwasher (7)
6. Washer (3)	47. Extension panel	80. Rear panel
7. CapscREW (4)	48. Mounting plate	81. Louver (6)
8. Cottér pin	49. CapscREW (9)	82. Louver bracket (6)
9. Lockwasher	50. Nut (9)	83. Positioning plate
10. Handle	51. Lockwasher (9)	84. CapscREW (2)
1. Latch	52. CapscREW (6)	85. Nut (2)
2. Handle	53. Flat washer (24)	86. Lockwasher (2)
3. Machine screw (2)	54. Lock washer (24)	87. Control lever
4. Lockwasher (2)	55. Rear side panel	88. CapscREW (2)
5. CapscREW (4)	56. Nut (11)	89. Nut (2)
6. Lock	57. Lockwasher (11)	90. Lockwasher (2)
7. Key	58. CapscREW (14)	91. Actuating arm
8. Safety glass	59. Lockwasher (14)	92. CapscREW (16)
3A. Door	60. Nut (14)	93. Shutter
9. Weather strip	61. Side panel	94. CapscREW (11)
10. Backup strip	62. CapscREW (23)	95. Operating rod
1. Rubber seal strap	63. Mounting bracket	96. Ball joint (2)
2. Roundhead machine screw (3)	64. CapscREW (9)	

Figure 2-68(1)—Continued

(2) Remove upper connection hoses and hose clamps (fig. 2-69).

(3) Remove all fan guard capscREws and lockwashers and remove fan guard.

(4) Remove lower connection hoses and hose clamps.

(5) Remove drain line hose clamps.

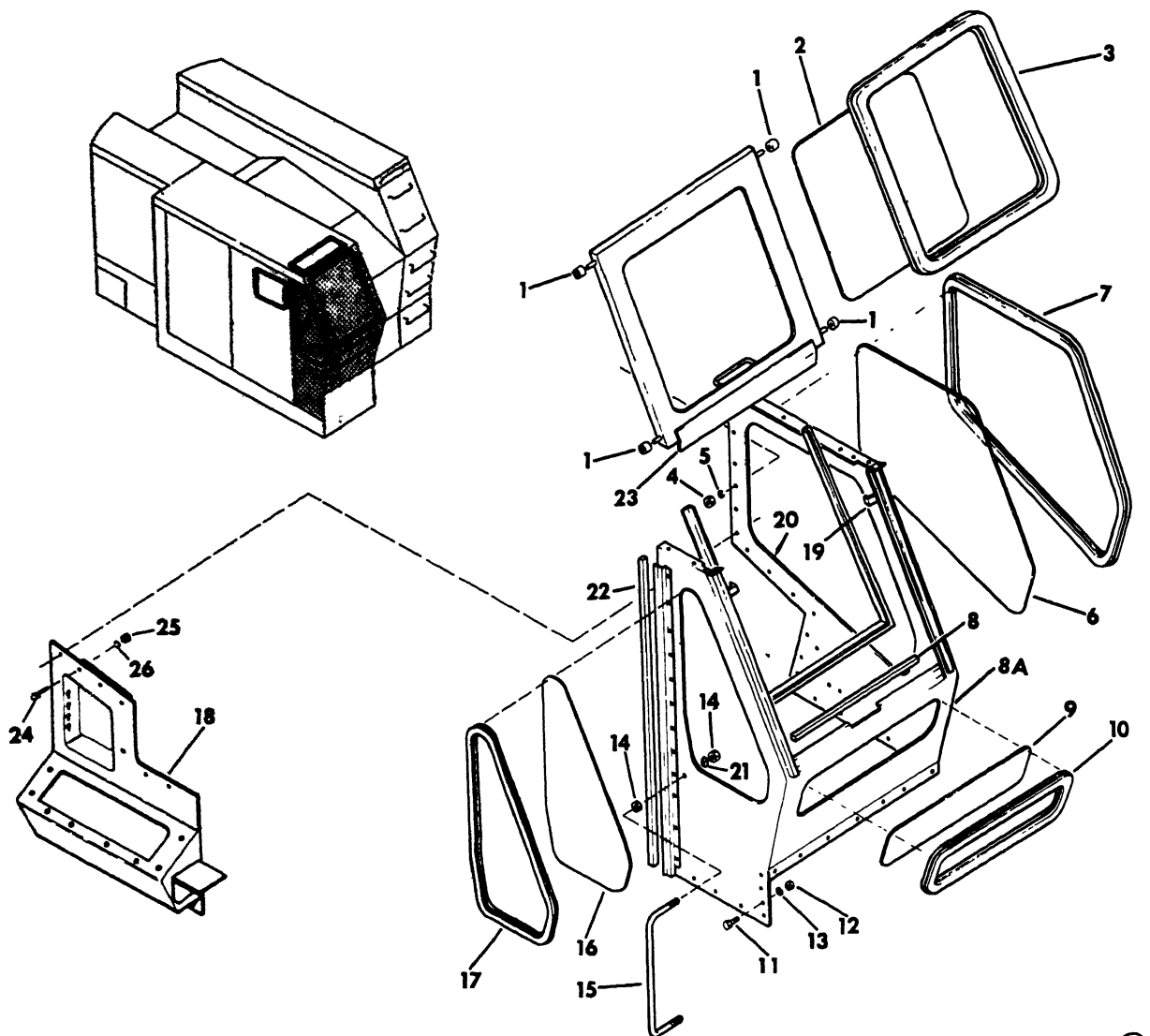
(6) Support the radiator so it can not fall and attach a suitable lifting device.

(7) Remove one nut and three washers from the mounting studs on each side.

(8) Remove radiator braces. One brace is on each side of the engine.

(9) Lift radiator until mounting studs clear the mounting brackets. Then remove the radiator through the rear of the cab where rain shutters and sheet metal have been removed.

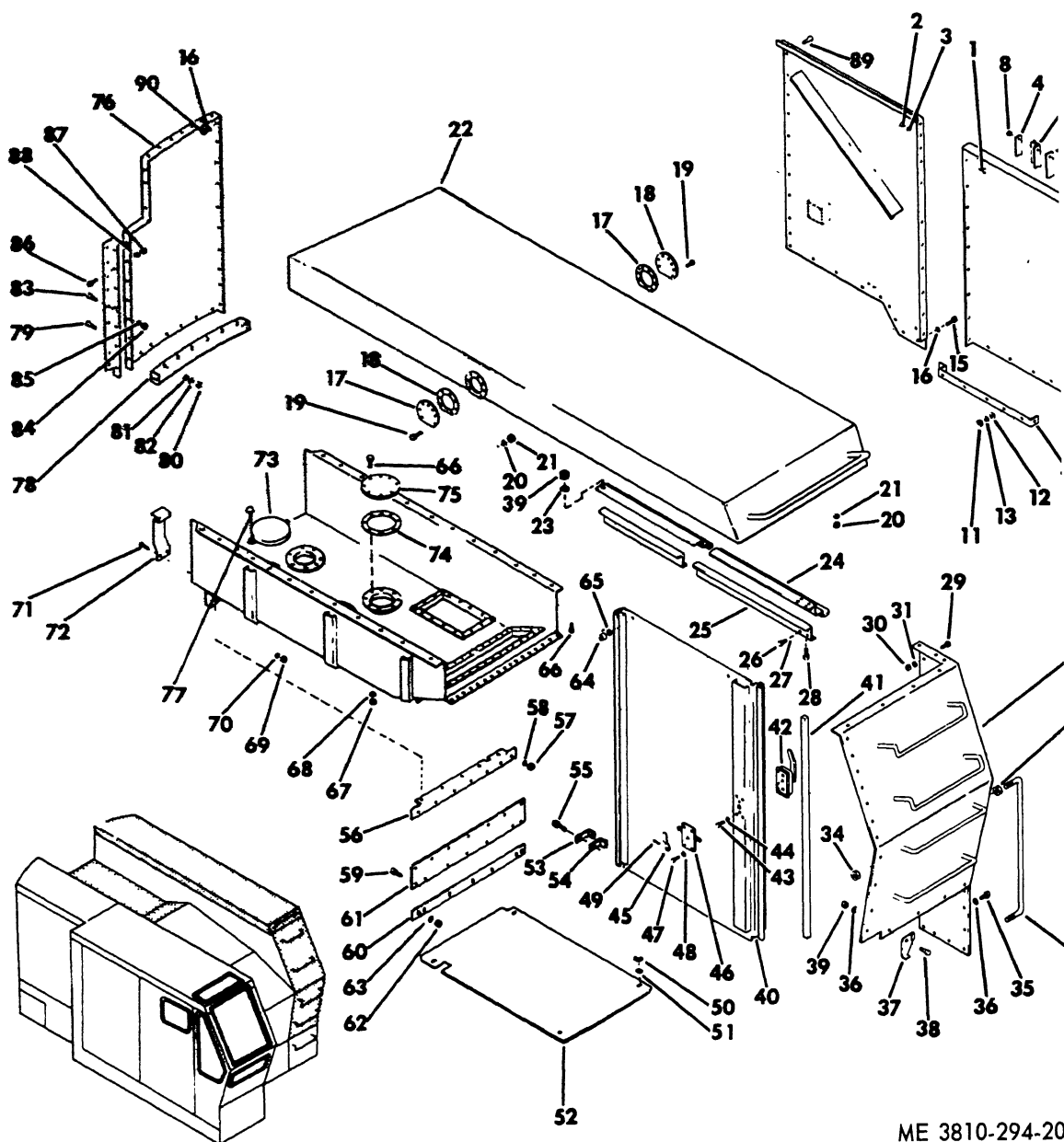
(10) Replace by performing (1) through (9) in reverse order.



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- | | | |
|------------------|---------------------|---------------------|
| 1. Roller (4) | 9. Safety glass | 18. Control box |
| 2. Safety glass | 10. Weatherstrip | 19. Fastener (4) |
| 3. Weatherstrip | 11. Capscrew (19) | 20. Bracket |
| 4. Nut | 12. Nut (19) | 21. Washer (5) |
| 5. Lockwasher | 13. Lockwasher (19) | 22. Rubber strip |
| 6. Safety glass | 14. Nut (4) | 23. Rubber strip |
| 7. Weatherstrip | 15. Cab handle | 24. Capscrew (12) |
| 8. Rubber strip | 16. Safety glass | 25. Nut (12) |
| 8A. Cab assembly | 17. Weatherstrip | 26. Lockwasher (12) |

Figure 2-68. Cab sheet metal assembly, removal and replacement, (sheet 2 of 6).



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- | | | |
|--------------------------|---------------------|----------------------|
| 1. Capscrew (36) | 14. Bracket | 27. Lockwasher (4) |
| 2. Nut (36) | 15. Capscrew (9) | 28. Capscrew (8) |
| 3. Lockwasher (44) | 16. Lockwasher (31) | 29. Capscrew (13) |
| 4. Backup strip | 17. Cover plate (2) | 30. Nut (13) |
| 5. Rubber strip | 18. Gasket (2) | 31. Lockwasher (13) |
| 6. Shim | 19. Capscrew (14) | 32. Left front panel |
| 7. Machine screw (11) | 20. Nut (8) | 33. Cab handle |
| 8. Self-locking nut (11) | 21. Lockwasher (8) | 34. Nut (4) |
| 9. Capscrew (8) | 22. Left canopy | 35. Capscrew (12) |
| 10. Capscrew (8) | 23. Lockwasher (52) | 36. Lockwasher (30) |
| 11. Nut (8) | 24. Gutter | 37. Cover latch |
| 12. Flat washer (8) | 25. Guide | 38. Capscrew (18) |
| 13. Lockwasher (8) | 26. Capscrew (4) | 39. Nut (52) |

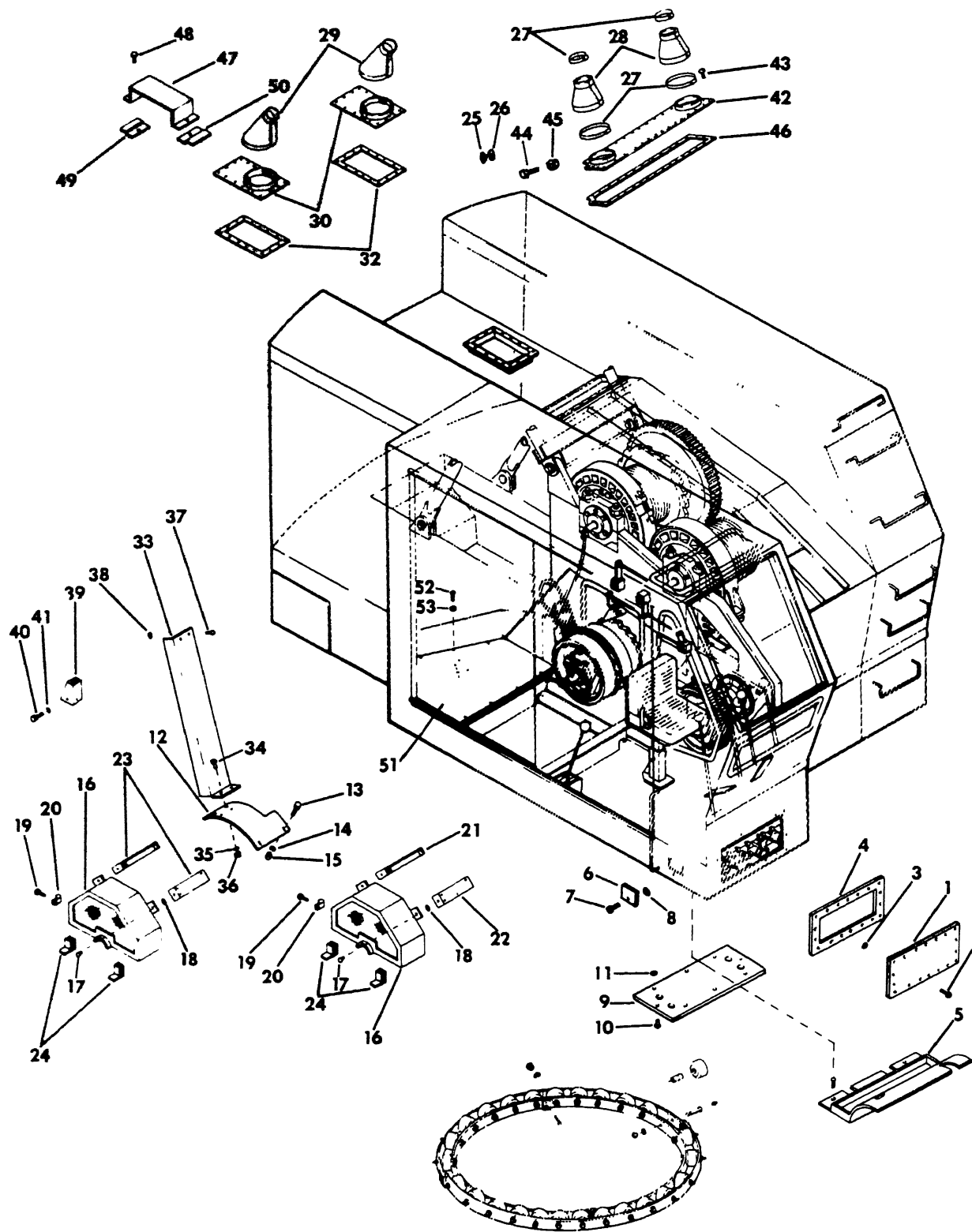
Figure 2-68. Cab sheet metal assembly, removal and replacement, (sheet 4 of 6).

40. Sliding door
41. Rubber strip
42. Handle
43. Machine screw (2)
44. Lockwasher (2)
45. Plate
46. Latch
47. Capscrew (4)
48. Lockwasher (48)
49. Cotter pin
50. Wing nut (4)
51. Lockwasher (4)
52. Bottom engine cover
53. Backup strip
54. Rubber seal
55. Machine screw (3)
56. Angle

57. Nut (16)
58. Lockwasher (16)
59. Capscrew (14)
60. Mounting plate
61. Bottom panel
62. Nut (14)
63. Lockwasher (14)
64. Ball bearing (2)
65. Flat washer (2)
66. Capscrew (8)
67. Nut (8)
68. Lockwasher (8)
69. Nut (2)
70. Lockwasher (2)
71. Machine screw (2)
72. Spring lock
73. Cover

74. Gasket (2)
75. Cover (2)
76. Rear Panel
77. Thumb screw
78. Bracket
79. Capscrew (9)
80. Nut (9)
81. Flat washer (9)
82. Lockwasher (9)
83. Capscrew (20)
84. Nut (20)
85. Flat washer (20)
86. Capscrew (7)
87. Nut (7)
88. Lockwasher (7)
89. Capscrew (22)
90. Nut (22)

Figure 2-68(4)—Continued

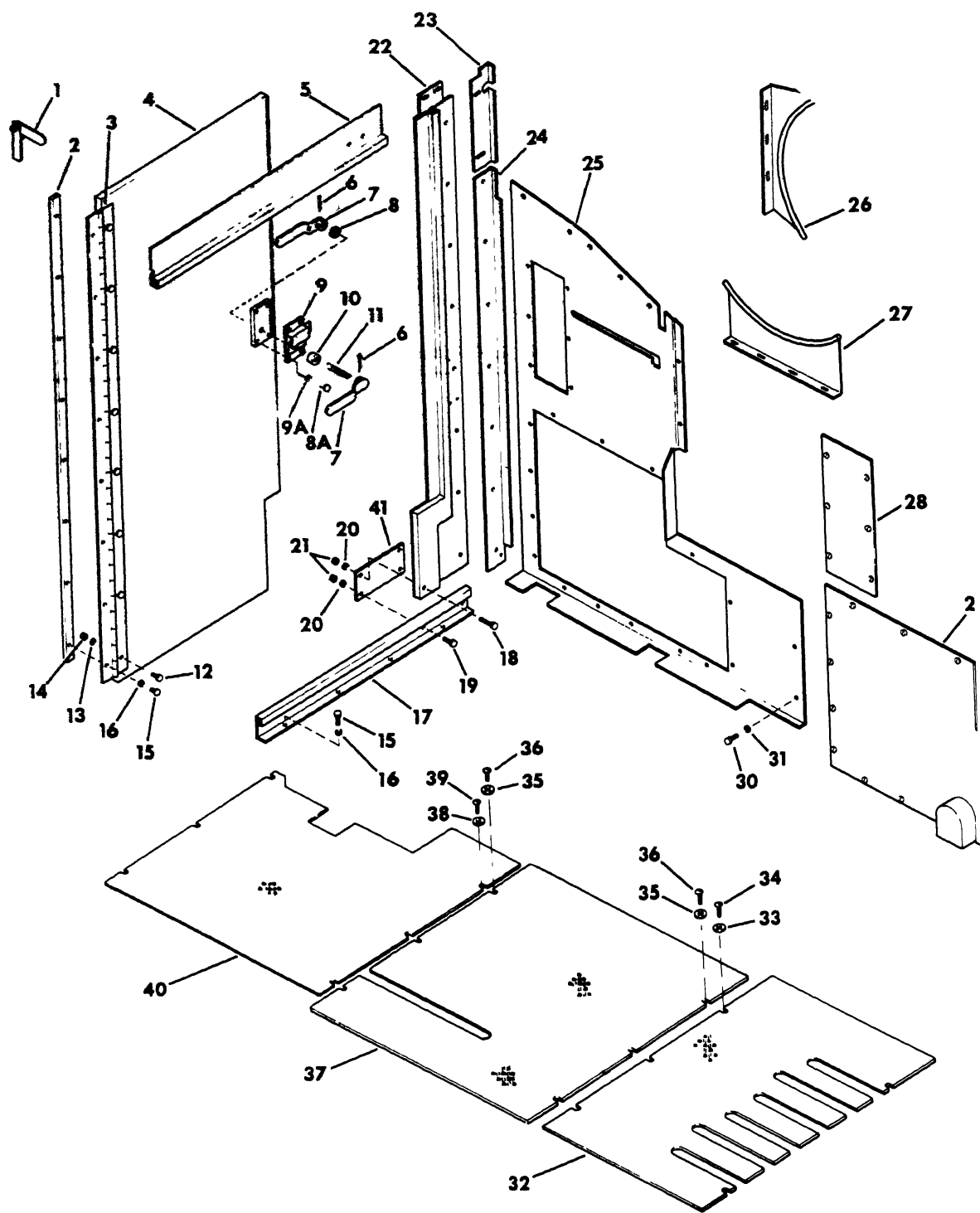


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Figure 2-68. Cab sheet metal assembly, removal and replacement, (sheet 5 of 6).

- | | | |
|------------------------|------------------------|--------------------------|
| 1. Cover | 19. Capscrew (2) | 37. Fastener (4) |
| 2. Fastener (16) | 20. Loop clamp (2) | 38. Plastic washer (4) |
| 3. Plastic washer (16) | 21. Bracket | 39. Cable cover |
| 4. Gasket set | 22. Bracket | 40. Capscrew (4) |
| 5. Dirt trough | 23. Bracket (2) | 41. Lockwasher (4) |
| 6. Cover | 24. Bracket (4) | 42. Cab cover |
| 7. Fastener | 25. Flat washer | 43. Machine screw (29) |
| 8. Plastic washer | 26. Flat washer | 44. Machine screw (4) |
| 9. Cover | 27. Boot clamp (8) | 45. Self-locking nut (4) |
| 10. Fastener (8) | 28. Gantry boot (2) | 46. Gasket assembly |
| 11. Plastic washer (8) | 29. Gantry boot (2) | 47. Cover |
| 12. Cover | 30. Cover (2) | 48. Capscrew |
| 13. Capscrew (4) | 31. Machine screw (16) | 49. Bracket |
| 14. Lockwasher (4) | 32. Gasket (2) | 50. Bracket |
| 15. Nut (4) | 33. Cover | 51. Floor plate |
| 16. Guard assembly (2) | 34. Capscrew (2) | 52. Machine screw (6) |
| 17. Fastener (2) | 35. Lockwasher (2) | 53. Flat washer (6) |
| 18. Plastic washer (2) | 36. Nut (2) | |

Figure 2-63(5)—Continued

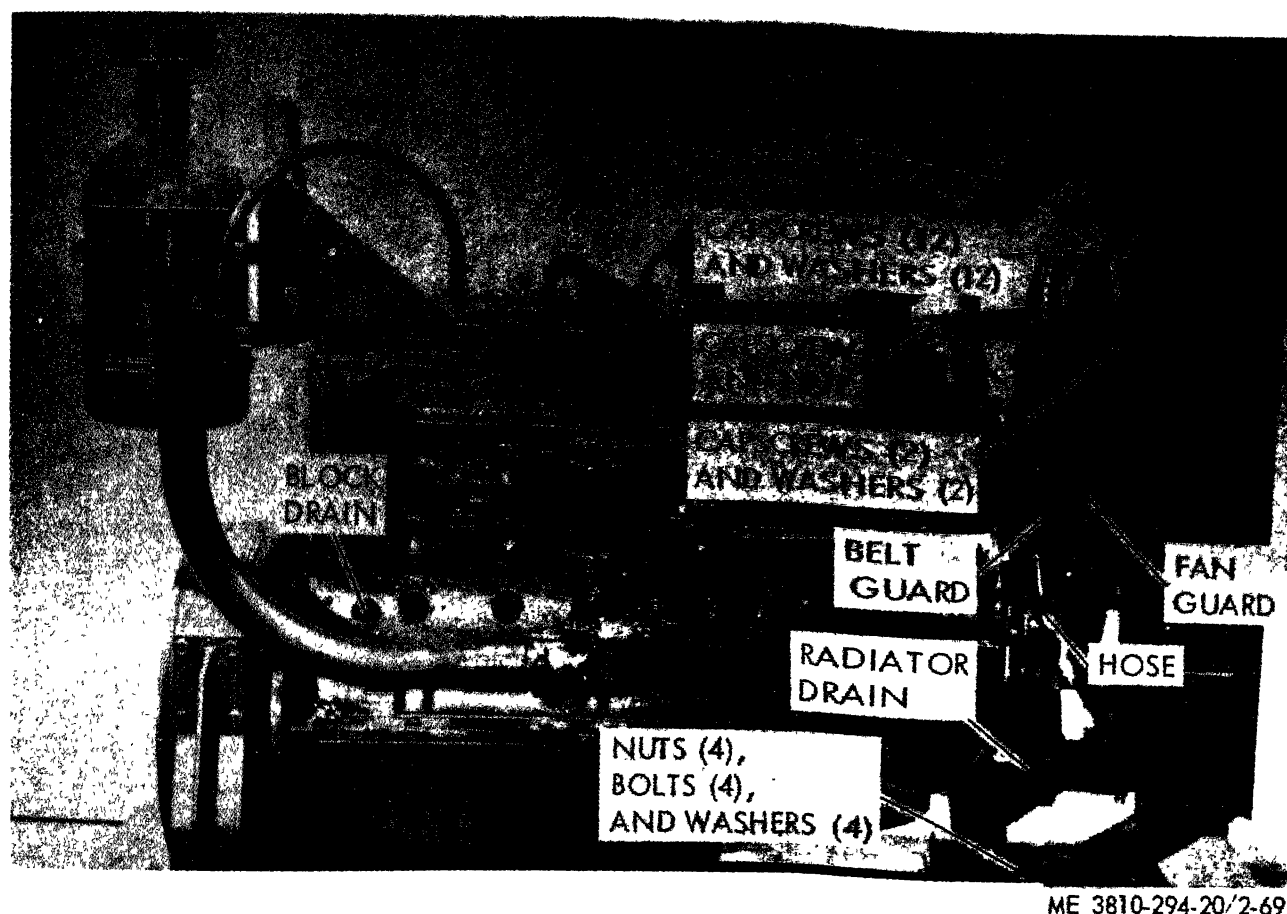


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Figure 2-68. Cab sheet metal assembly, removal and replacement, (sheet 6 of 6).

- | | | |
|--------------------|---------------------|-----------------------|
| 1. Door stop | 14. Nut (8) | 29. Cover |
| 2. Strip | 15. Capscrew (12) | 30. Capscrew (2) |
| 3. Hinge | 16. Lockwasher (12) | 31. Lockwasher (2) |
| 4. Door assembly | 17. Door jam | 32. Front floor plate |
| 5. Door jam | 18. Capscrew | 33. Flat washer (5) |
| 6. Cotter pin (2) | 19. Capscrew (13) | 34. Machine screw (5) |
| 7. Handle (2) | 20. Lockwasher (14) | 35. Flat washer (6) |
| 8. Washer | 21. Nut (14) | 36. Machine screw (6) |
| 8A. Screw | 22. Door jam | 37. Floor plate |
| 9. Cab door lock | 23. Strip | 38. Flat washer (6) |
| 9A. Lockwasher | 24. Strip | 39. Machine screw (6) |
| 10. Sleeve | 25. Panel | 40. Floor plate |
| 11. Square | 26. Cable guard | 41. Support |
| 12. Capscrew (8) | 27. Cable guard | |
| 13. Lockwasher (8) | 28. Cover | |

Figure 2-68(6)—Continued



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Figure 2-69. Radiator, guard, and hoses, removal.

Section XXII. MAINTENANCE OF TRANSMISSION ASSEMBLY AND PROPELLER SHAFT

2-75. Transmission Service

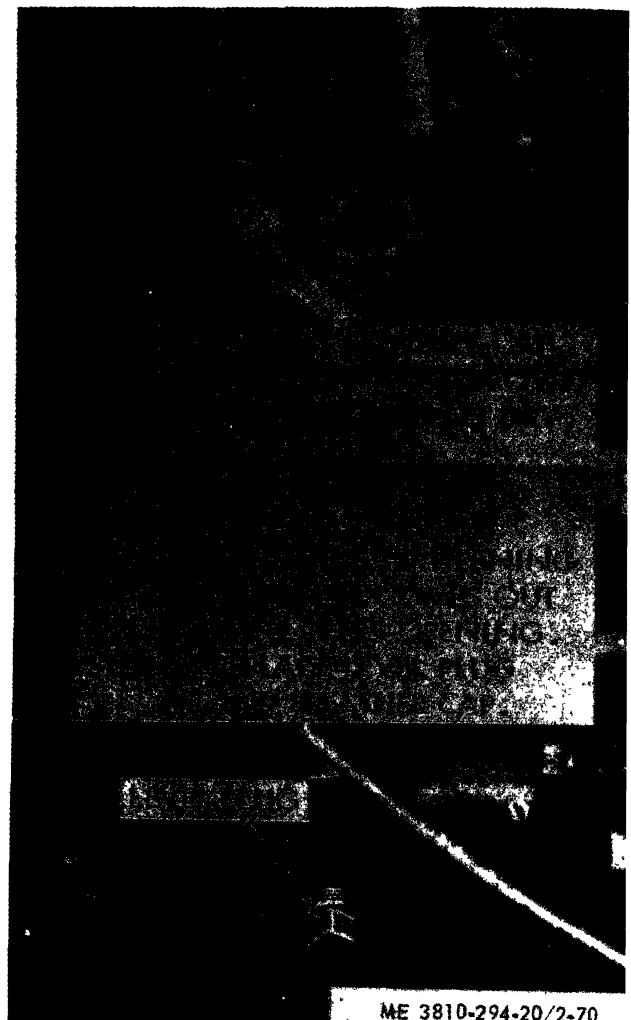
a. Inspect. Refer to figure 2-70 and inspect the transmission breather cap for cleanliness. If necessary, rinse the cap in clean diesel fuel or kerosene and allow to drain before replacing. Inspect the transmission for signs of oil leaks or damage.

b. Service. Refer to figure 2-70 and service the transmission.

2-76. Propeller Shaft, Service and Replacement

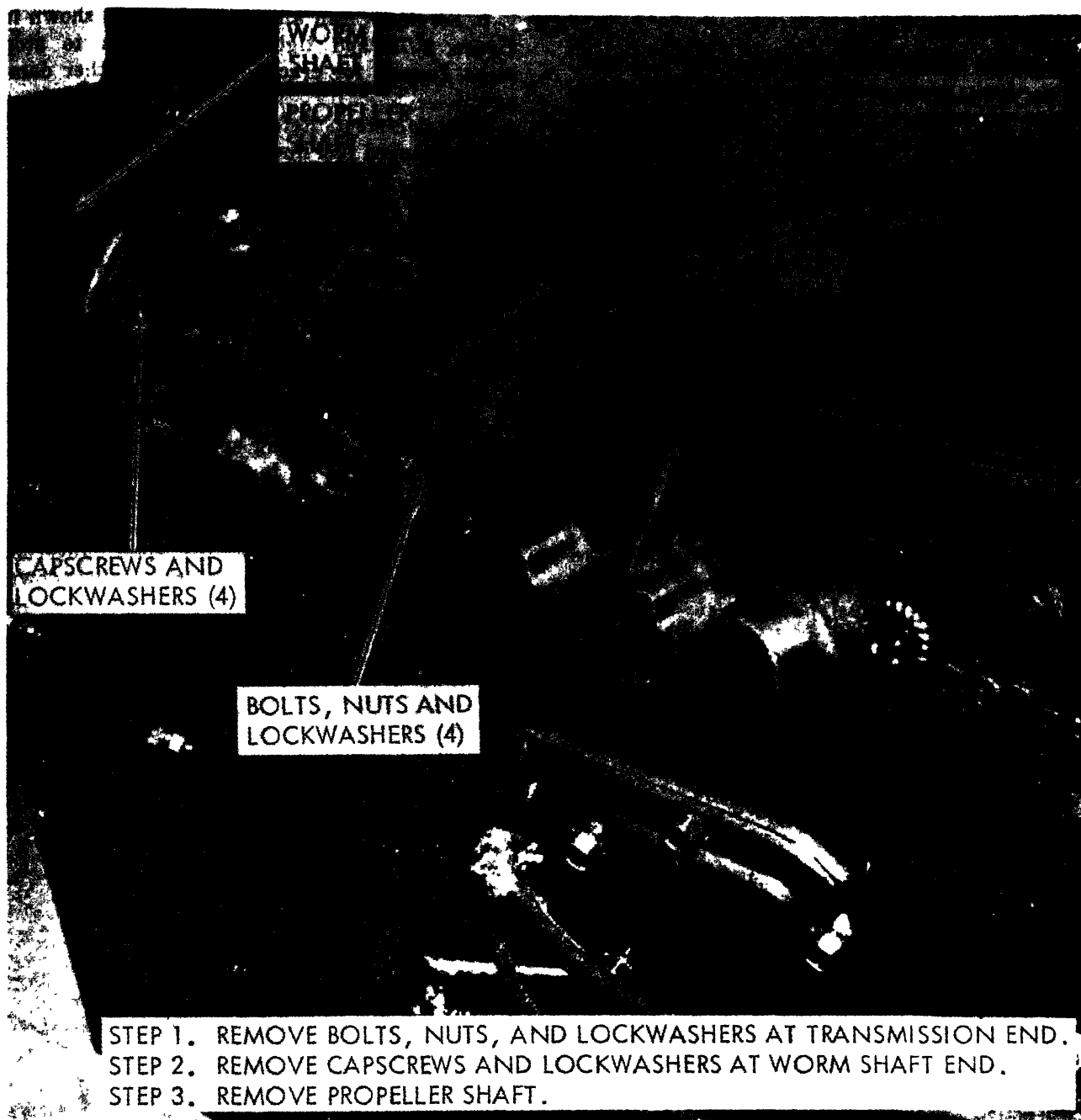
a. Service. Lubricate the propeller shaft with the lubricant and at intervals shown in the lubrication order.

b. Replacement. Refer to figure 2-71 and remove or replace the propeller shaft.



ME 3810-294-20/2-70

Figure 2-70. Transmission inspection and service.



ME 3810-294-20 2-71

Figure 2-71. Propeller shaft, removal.

Section XXIII. MAINTENANCE OF FUEL SYSTEM

2-77. General

The engine fuel system consists of the fuel tank, lines, fuel pump, sediment bowl, carburetor, engine governor, air cleaner, and other components described in this section. Organizational level maintenance authorized for the components of this system follows.

2-78. Air Cleaner Assembly, Service and Replacement

a. *General.* The air cleaner is of the oil-cup type. It is located at the rear of the engine, on a bracket mounted on the flywheel housing. It contains a removable filter element and a fixed non-removable element.

b. *Removal and Replacement.* Refer to figure 2-72 and remove and replace the air cleaner.

2-79. Fuel Tank Lines and Fittings, Replacement

a. *General.* The fuel lines and fittings are those lines and fittings that connect the fuel tank to the engine fuel pump.

b. *Service.* Clean all accessible items shown figure 2-73 and tighten connections to stop leaks. Inspect for cracks, breaks, or other damage.

c. *Replacement.* Refer to figure 2-73 and replace damaged fuel lines and fittings.

2-80. Fuel Filter (Sediment Bowl) Service and Replacement

Refer to figure 2-74 for service and replacement of the fuel filter sediment bowl.

2-81. Engine Speed Governor and Controls

a. *General.* The engine throttle, figure 2-75, is used to maintain the desired engine speed by increasing or decreasing speed governor spring settings, figure 2-76, in response to changes in engine load. An example of a change in engine load occurs when the crane operator begins to lift a load. At this time, the speed governor senses a tendency for the engine to slow down. This automatically causes the governor linkage

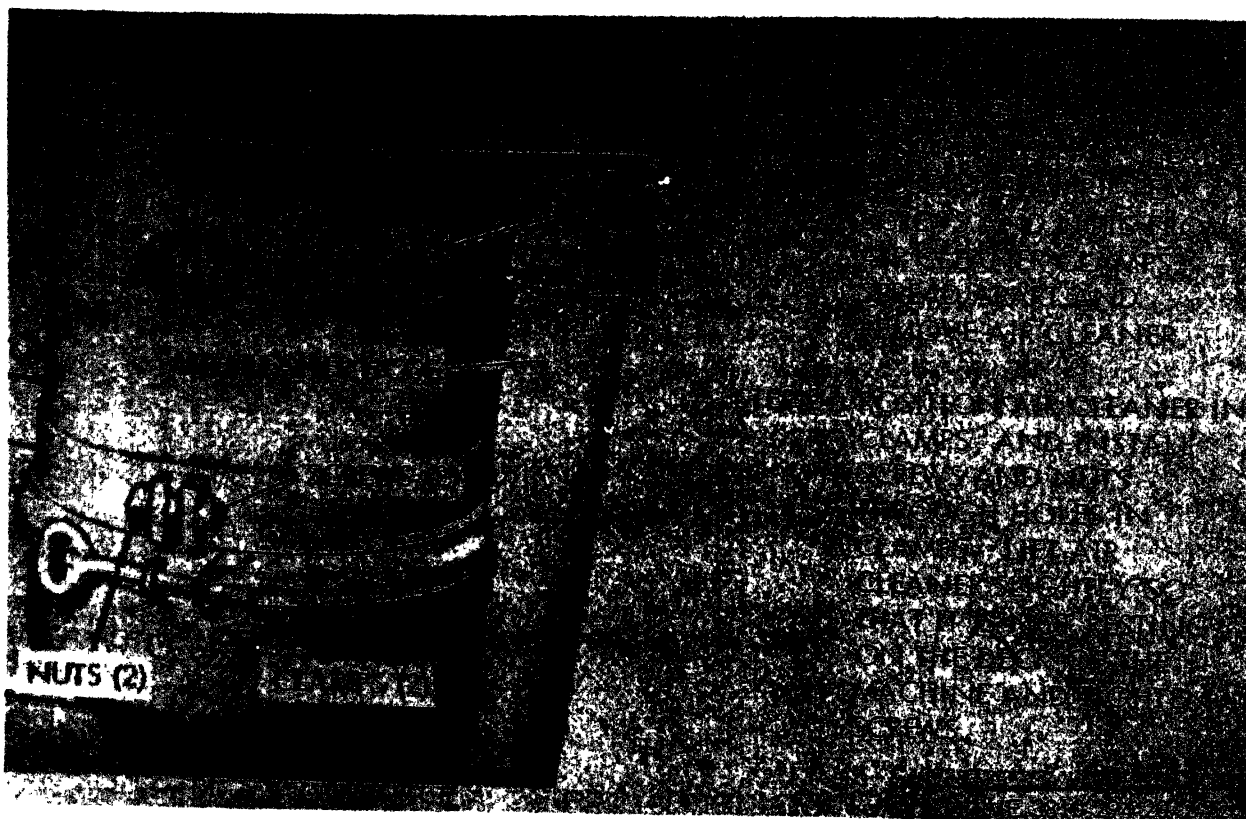
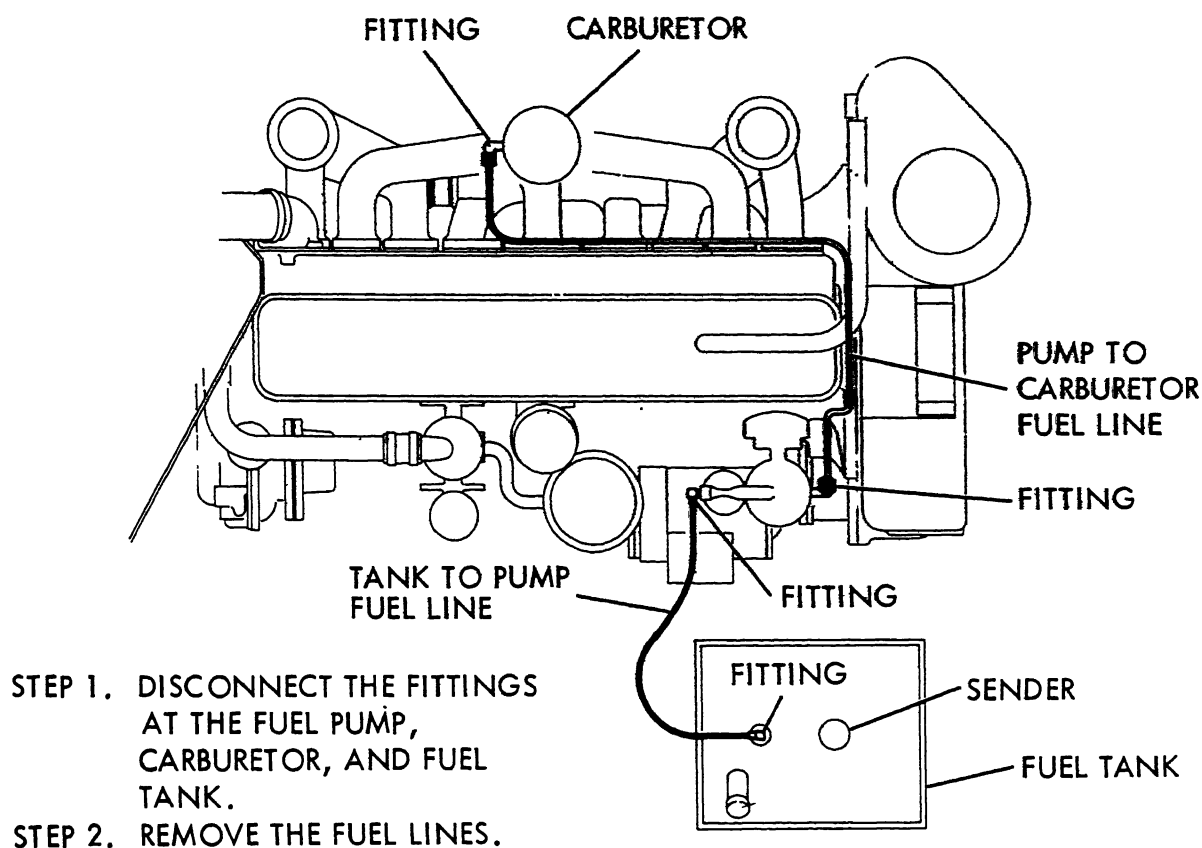


Figure 2-72. Engine air cleaner, removal and replacement.



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Figure 2-73. Lines and fittings, removal.

to open the carburetor throttle valve, thus allowing more fuel to enter the engine. The additional fuel prevents the engine from slowing down, and the governor has maintained the engine at the desired speed, which is represented by the throttle setting.

b. *Speed Governor Removal.* Refer to figure 2-77 and remove the speed governor.

c. *Speed Governor Replacement.* Refer to figure 2-77 and install the speed governor.

d. *Speed Governor Adjustment.*

(1) Adjust the length of the linkage from the carburetor side of the cross-shaft shown in figure 2-76 as follows:

(a) Push throttle lever (fig. 2-75) forward so throttle lever (fig. 2-76) is against the low speed stop. Check linkage on opposite side of engine to be sure the carburetor throttle valve is closed.

(b) Move the throttle lever (fig. 2-75) fully back and see that throttle lever (fig. 2-76) is

against the high-speed stop. Full movement of the throttle lever (fig. 2-75) should result in full range movement of throttle lever (fig. 2-76). With throttle lever against highspeed stop, check to see that throttle valve is approximately full open.

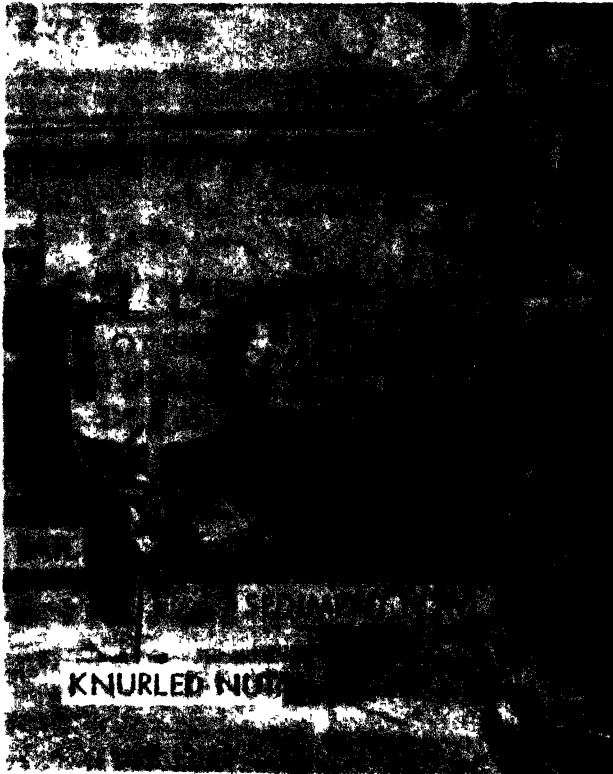
(2) Run engine until normal operating temperature is obtained.

(3) Refer to paragraph 2-83b and adjust carburetor.

(4) Pull throttle lever (fig. 2-76) back to obtain high-idle speed (para 1-7).

(5) Apply load to engine sufficient to reduce engine speed to normal governed speed and determine if carburetor throttle lever is wide open. If the throttle lever is wide open, move governor linkage (fig. 2-76) slightly toward closed position and then release. Now the linkage must return the carburetor lever to the wide open position.

(6) Adjust high-speed stop screw (fig. 2-



- STEP 1. LOOSEN KNURLED NUT.
 STEP 2. TURN BAIL ASIDE AND REMOVE SEDIMENT BOWL. BE CAREFUL NOT TO SPILL GASOLINE.
 STEP 3. CLEAN SEDIMENT BOWL. REINSTALL BOWL, REPLACE BAIL, AND TIGHTEN KNURLED NUT.

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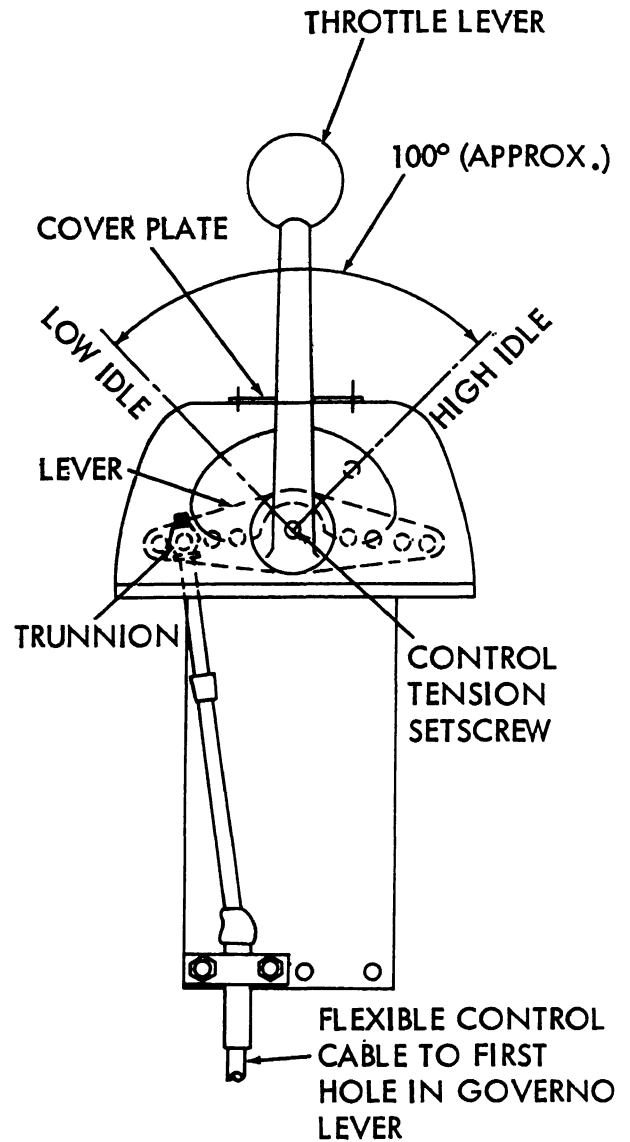
Figure 2-74. Fuel filter service.

76) so it just contacts throttle lever. Check to see that engine fast idle speed is correct (para 1-7).

2-82. Engine Throttle and Choke Controls

a. Engine Throttle Control.

(1) *Adjustment.* Adjustable setscrews are located beneath the cover plate in figure 2-75. Adjust these setscrews so the throttle lever will move through an arc of approximately 100 degrees, 50 degrees on either side of vertical. This adjustment should never have to be repeated or checked. Then adjust the control tension set-



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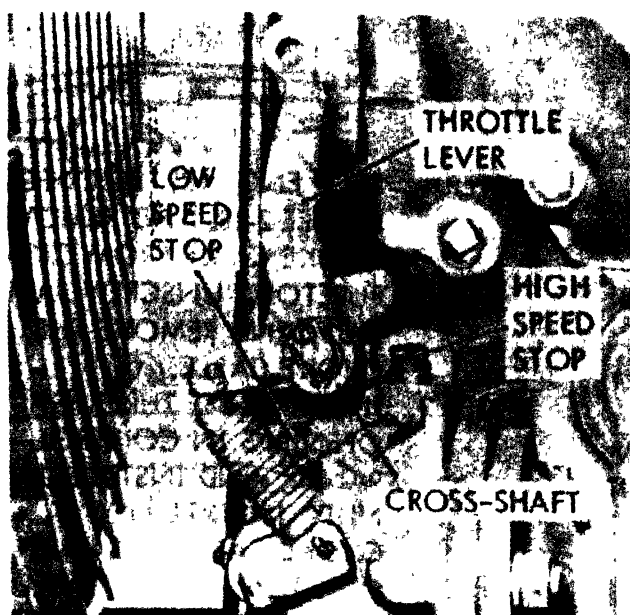
Figure 2-75. Engine throttle adjustment.

screw so the throttle lever holds firm in any desired position.

(2) *Replacement.* The flexible control cable from the engine throttle lever is attached at its opposite end to the engine speed governor lever. See figure 2-77. Remove necessary cable clamp and remove the flexible control cable. Install a new control cable. Attach this control cable to the lowest hole in the governor lever. Attach to the throttle lever as shown in figure 2-75.

b. Engine Choke Control.

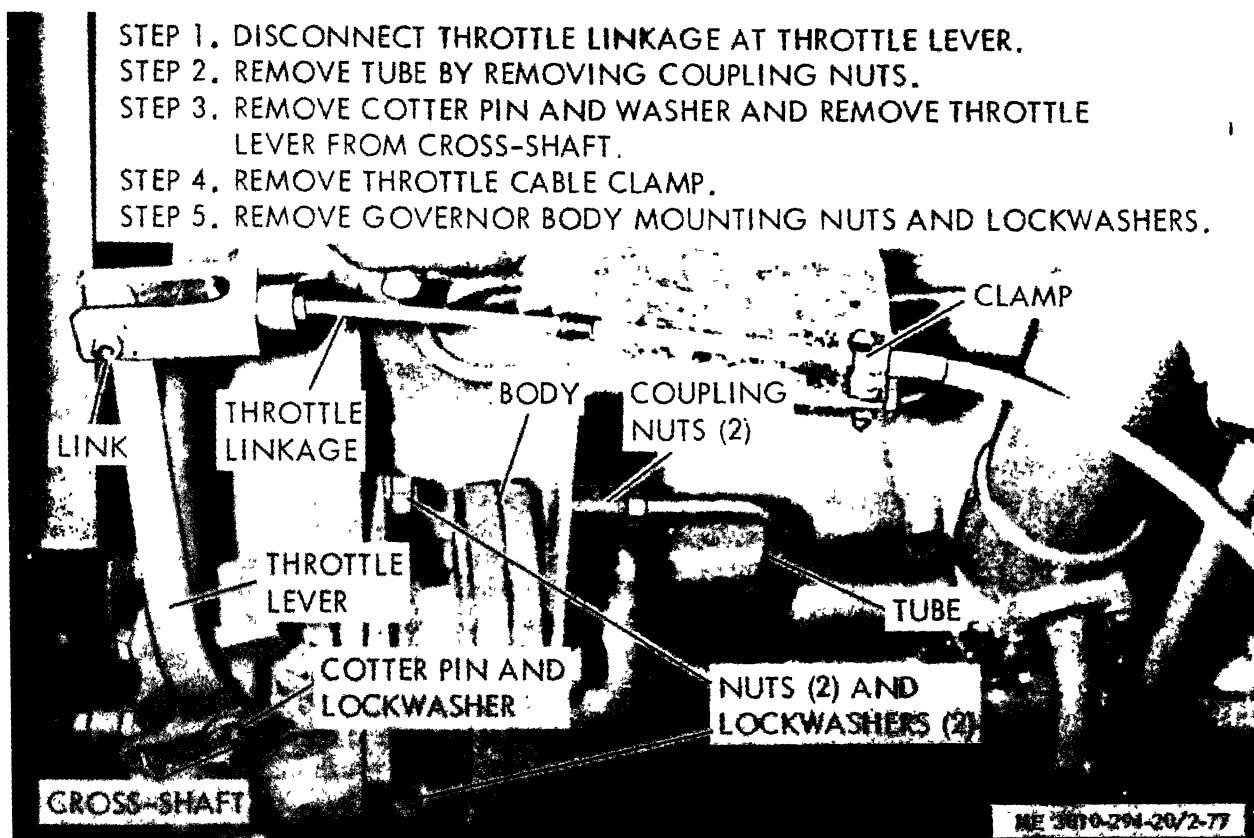
(1) *General.* The engine choke control is used to position the carburetor choke valve for



- STEP 1. BACK OFF HIGH AND LOW SPEED STOPS. PUSH ENGINE THROTTLE (FIGURE 2-75) FORWARD UNTIL THROTTLE LEVER CONTACTS LOW SPEED STOP. START ENGINE AND CHECK LOW IDLE SPEED. ADJUST LOW SPEED STOP UNTIL SPEED IS CORRECT. REFER TO PARAGRAPH 1-6.
- STEP 2. PULL THROTTLE (FIGURE 2-75) FULL BACK AND ADJUST HIGH SPEED STOP IN THE MANNER DESCRIBED ABOVE. CHECK ENGINE HIGH AND LOW IDLE SPEEDS AS LISTED IN PARAGRAPH 1-7.

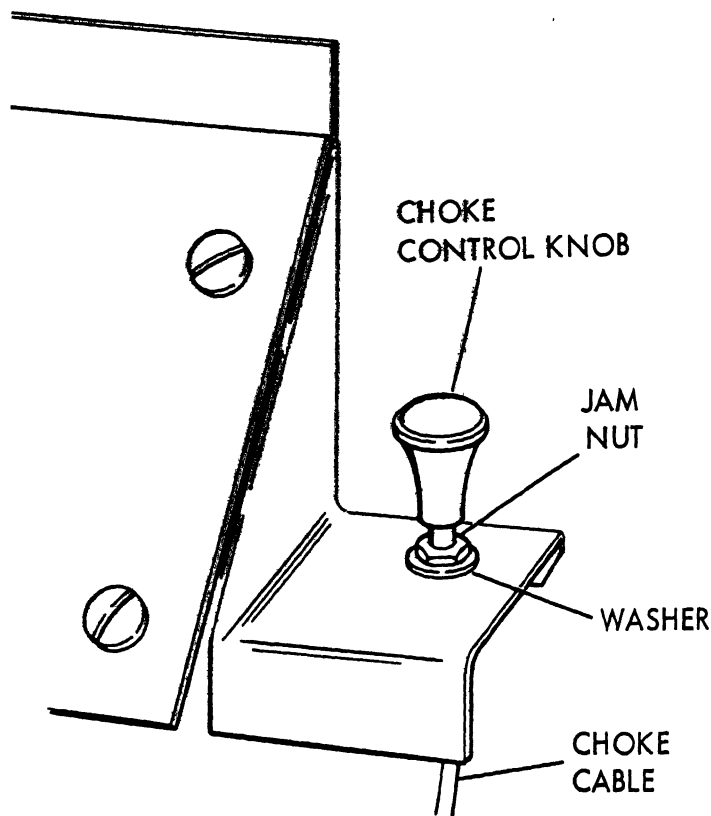
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Figure 2-76. Engine speed governor adjustment.



- STEP 1. DISCONNECT THROTTLE LINKAGE AT THROTTLE LEVER.
- STEP 2. REMOVE TUBE BY REMOVING COUPLING NUTS.
- STEP 3. REMOVE COTTER PIN AND WASHER AND REMOVE THROTTLE LEVER FROM CROSS-SHAFT.
- STEP 4. REMOVE THROTTLE CABLE CLAMP.
- STEP 5. REMOVE GOVERNOR BODY MOUNTING NUTS AND LOCKWASHERS.

Figure 2-77. Engine speed governor, removal.



STEP 1. STOP ENGINE. REFER TO FIGURE 2-80. AND REMOVE CHOKE CABLE FROM CARBURETOR. UNSCREW JAM NUT, AND REMOVE THE CHOKE CABLE.

STEP 2. INSERT CABLE THROUGH OPENING IN CONTROL PANEL, AND INSTALL JAM NUT. INSTALL NEW CHOKE CABLE IN SAME POSITION AS OLD CABLE ATTACH CABLE TO CARBURETOR AS SHOWN IN FIGURE 2-80.

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Figure 2-78. Engine choke control, removal and replacement.

best fuel mixture for starting purposes. The choke should be pulled fully out while starting, and then moved inward as much as possible as the engine warms up to normal operating temperatures.

(2) *Removal.* Refer to figure 2-78 and remove choke control components and lines.

(3) *Repair.* Tighten any loose connections. Replace any damaged parts.

(4) *Replacement.* Refer to figure 2-78 and replace choke control components.

2-83. Carburetor

a. *General.* The carburetor is of the updraft double-venturi type. It is designed to maintain proper fuel mixtures even though the vehicle is on very steep slopes. It is a "sealed and balanced" type, in that all air for bowl chamber ventilation and idling must come through the air filter. It is a sealed non-adjustable unit. The only remedy available is replacement if this carburetor does not operate properly. However, leaks can distort carburetor operation. Therefore, the carburetor mounting flange must be tight

and the flange gasket must not leak. If a flange nut is loose, air will enter and this will completely alter engine performance. Also the fuel tank must be suspected as a cause of trouble before replacing the carburetor. An unusual amount of fuel contamination may partly be due to the tank outlets or fuel lines, causing the carburetor to be starved for fuel. Under these circumstances, the fuel tank must be drained and refilled (TM 5-3810-294-10) before replacing the carburetor. If the air cleaner oil is not clean or is of the wrong type, or if too much oil is in the air cleaner, this will restrict air flow to the carburetor, making it appear that the carburetor needs replacement. All of these items must be checked before replacing the carburetor.

b. *Adjustment.* The upper carburetor is adjustable, with the exception of the linkage to the carburetor, which must not have excess slack. Refer to figure 2-79 for a view of carburetor linkage.

c. *Removal and Replacement.* Refer to figure 2-80 and remove and replace the carburetor.

fuel will be caused by some factor other than the fuel pump.

(3) When testing the fuel pump, first see that there is adequate fuel in the tank.

(4) Disconnect the line from the fuel tank to the fuel pump at the pump and see that fuel flows freely. If it does, fuel is available at the fuel pump and the line to the tank is in good condition. Reconnect the line.

(5) Connect a pressure gage in the input fuel line at the carburetor as shown in figure 2-81. Be sure the length of the connecting hose is as shown and that all connections are leak proof.

(6) Start the engine and run it at 500 rpm. Stop the engine when the maximum fuel pressure has been read on the gage. If the pressure is below 3 1/2 psi or above 5 psi, replace the fuel pump.

c. Removal and Replacement. Refer to figure 2-82 and remove and replace a faulty fuel pump. Note that this fuel pump includes a sediment bowl.

NOTE

Before installing a new fuel pump, make sure it is in good condition. To do so, follow steps (1) through (4) below.

(1) Hold the fuel inlet and output openings closed with the fingers of one hand.

(2) Move the lever (fig. 2-82) up and down. The pump will create a feeling of suction and pressure as the lever is moved, if it is in good condition.

(3) When installed, if there is an air leak between the sediment bowl and the bowl gasket, the pump cannot draw fuel into the bowl. To fix, install new gasket and be sure the bowl seats firmly. Also tighten knurled nut beneath bowl.

(4) If the strainer bowl still does not fill, air may be trapped in lines to the pump. To fix, loosen bowl slightly so air can escape and blow into fuel-tank filler neck. This will force fuel into fuel pump bowl. Now tighten the bowl down securely.

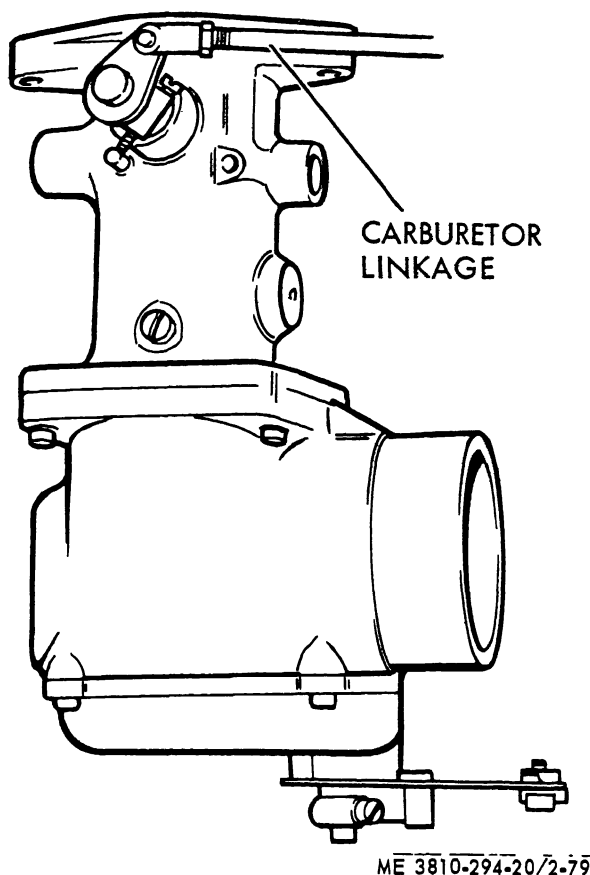


Figure 2-79. Carburetor linkage.

2-84. Fuel Pump

a. General. The fuel pump is a mechanical type with offset filter. The suction side of the pump is connected to the fuel tank and the discharge side to the carburetor, where the fuel accumulates in the carburetor float bowl for use as required by engine demand.

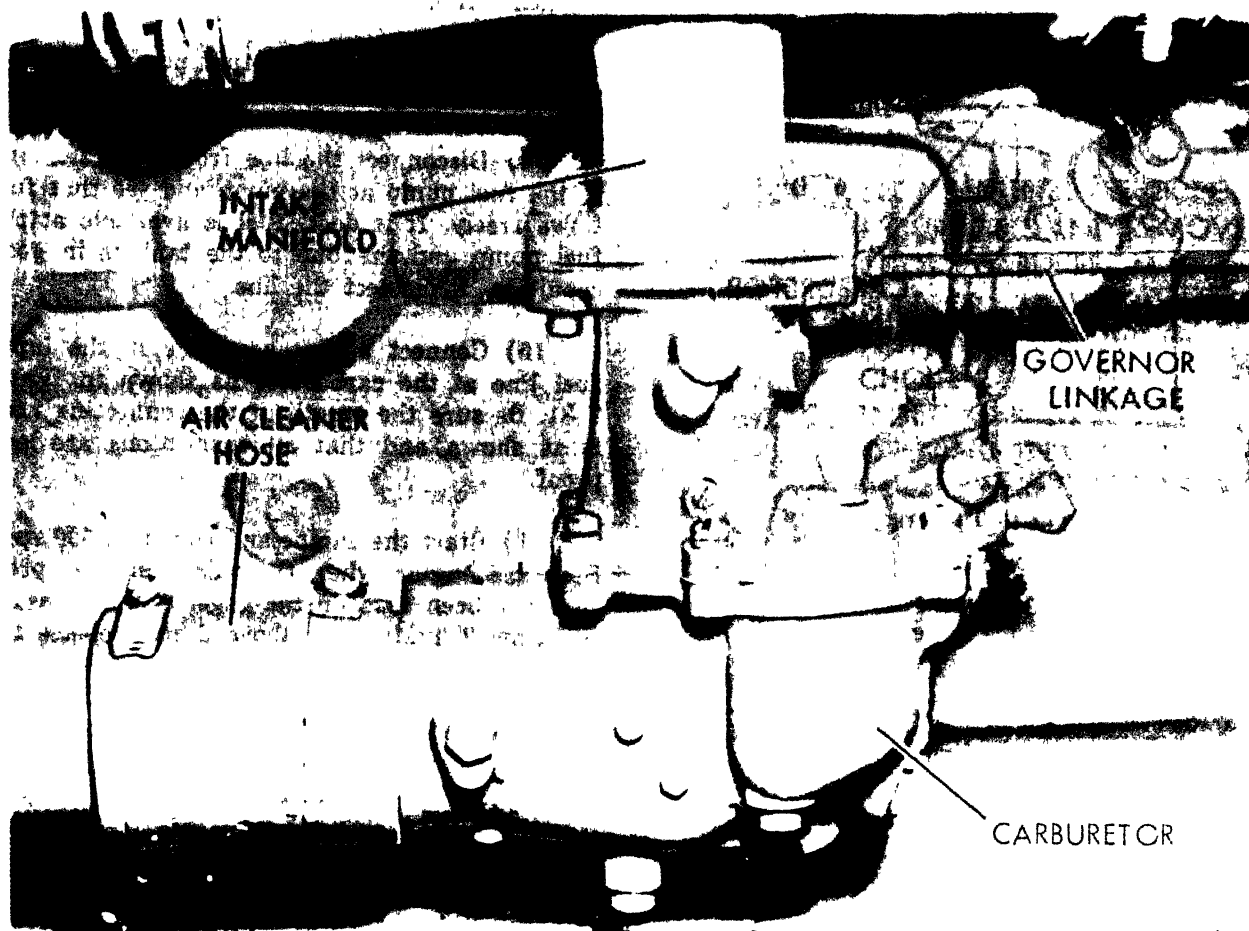
b. Test.

NOTE

The following test will be used to determine if it is necessary to replace the fuel pump.

(1) If the pump supplies too little fuel the engine will not run at all, or will falter or misfire under load.

(2) If the pump supplies too much fuel (which is rare), fuel will drip from the carburetor or the engine will not idle smoothly. The engine will be hard to start. Usually, too much



- STEP 1. STOP ENGINE. REMOVE AIR CLEANER HOSE, FUEL LINE, CHOKE CABLE, AND GOVERNOR LINKAGE FROM CARBURETOR.
- STEP 2. REMOVE BOLTS AND LOCKWASHERS. REMOVE CARBURETOR FROM INTAKE MANIFOLD AND REMOVE GASKET.
- STEP 3. INSTALL GASKET BETWEEN CARBURETOR AND INTAKE MANIFOLD. POSITION CARBURETOR ON INTAKE MANIFOLD AND INSTALL LOCKWASHERS AND BOLTS.
- STEP 4. CONNECT FUEL LINE, CHOKE CABLE, GOVERNOR LINKAGE, AND AIR CLEANER HOSE TO CARBURETOR.

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Figure 2-80. Carburetor, removal and replacement.

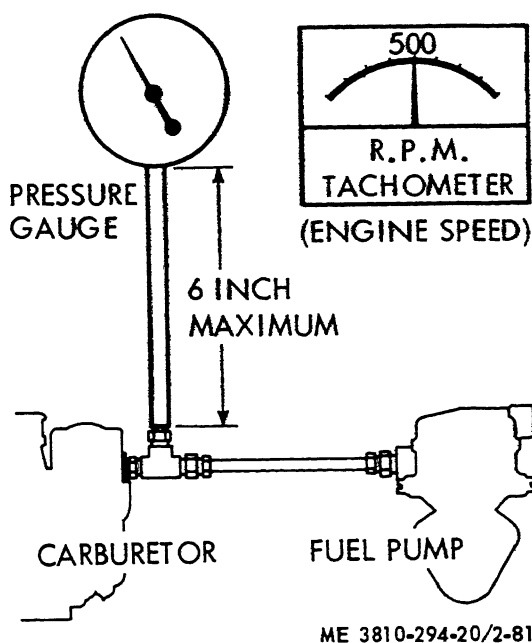
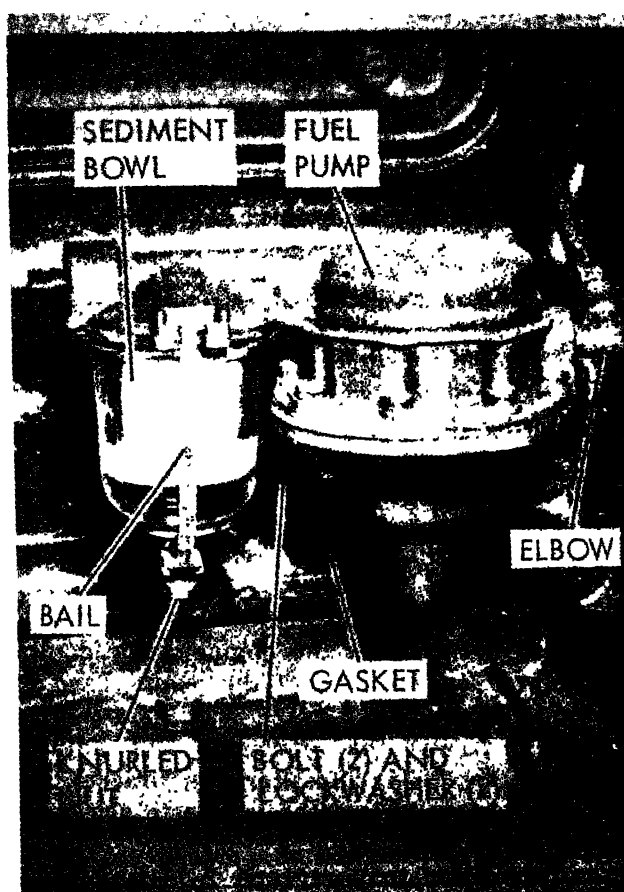


Figure 2-81. Checking fuel pump output pressure.



- STEP 1. STOP ENGINE. DISCONNECT FUEL LINES.
- STEP 2. REMOVE BOLTS AND LOCKWASHERS. REMOVE FUEL PUMP WITH SEDIMENT BOWL AND GASKET FROM ENGINE.
- STEP 3. POSITION FUEL PUMP ON ENGINE WITH GASKET BETWEEN PUMP AND ENGINE. INSTALL BOLTS AND LOCKWASHERS. RECONNECT FUEL LINES.
- STEP 4. LOOSEN KNURLED NUT AT THE BOTTOM OF BOWL, SWING BAIL ASIDE, AND REMOVE BOWL IF NECESSARY.
- STEP 5. WIPE OUT SEDIMENT BOWL WITH CLEAN CLOTH. INSTALL NEW GASKET ABOVE BOWL. POSITION

Figure 2-82. Fuel pump and fuel sediment bowl, removal and replacement.

Section XXIV. MAINTENANCE OF COOLING SYSTEM ACCESSORIES

2-85. Thermostat, Housing, and Gasket

a. General. When the engine is cold, the thermostat prevents the circulation of the coolant to the radiator and allows the coolant to circulate through the cylinder head and around the cylinders. When the engine coolant temperature reaches the thermostat setting, the thermostat opens, allowing the coolant to circulate through the engine block, cylinder head, and radiator.

b. Service. Keep the thermostat housing and lines tightened so that they do not leak. Wipe clean with a damp cloth, and remove any scale accumulations.

c. Removal. With the engine stopped and coolant temperature well below operating temperature, drain the coolant below the lever of the thermostat. Refer to figure 2-83 and remove and replace the thermostat, housing, gasket, or lines as follows.

(1) Loosen hose clamps and remove the hose between the thermostat housing and the radiator inlet pipe.

(2) Remove the bolts which secure the thermostat housing to the cylinder head.

(3) Remove the thermostat housing and thermostat from the cylinder head.

d. Test Before replacing, test the thermostat for proper operation by suspending it and a thermometer in a container of water. Heat the water. When the thermometer indicates between 160- and 165-degrees Fahrenheit, the thermostat should begin to open. It should be fully open when the temperature has risen to between 185- and 190-degrees Fahrenheit. Remove the thermostat from the water when it is fully open. The cool surrounding air should now cause the thermostat to close rapidly. Replace a defective thermostat.

NOTE

No repair of a faulty thermostat is possible. It must be replaced. Replace all gaskets when disassembly has occurred. Replace faulty hoses or hose clamps.

e. Installation. Refer to figure 2-83, place the thermostat into the housing and position the housing on the cylinder head. Be sure to use a new gasket. Fasten the housing to the cylinder head using the bolts provided. Install and secure the hose between the thermostat housing and the radiator inlet connection. Fill the system with the proper type and amount of coolant.



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Figure 2-83. Thermostat, housing, gaskets, and line.

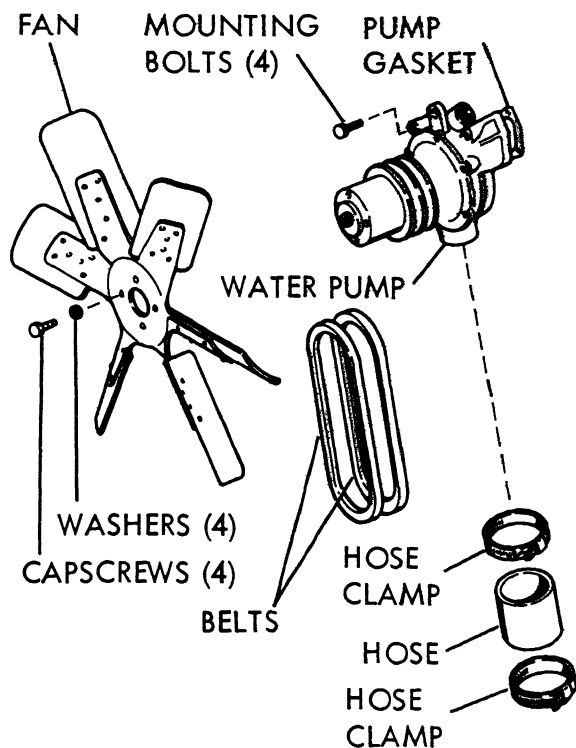
2-86. Water Pump, Replacement

a. General. The water pump (fig. 2-84) is driven by the engine fan pulley. It consists essentially of a two piece body and shaft mount impeller. Impeller rotation drives coolant throughout the cooling system by centrifugal force. The pump has no packing. Therefore, leaks develop, the pump must be removed for repair. The fan is mounted on the pulley.

b. Removal. With the engine stopped, drain coolant below the level of the pump. Then proceed as follows.

(1) Loosen the alternator belt adjustment screws (fig. 2-85) and alternator bracket. Move the alternator toward the engine to slacken the pump drive belts.

(2) Refer to paragraph 2-74 and remove the radiator.



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Figure 2-84. Water pump and fan replacement.

(3) Remove the capscrews and washers securing the fan and remove the fan. See figure 2-84.

(4) Remove the fan belts from the water pump pulley.

(5) Loosen hose clamps and remove hoses from the water pump.

(6) Remove the mounting bolts from the water pump and remove the pump from the engine. Remove pump gasket.

c. Installation. Refer to figure 2-84 and install the water pump as follows:

(1) Position the pump on the front of the crankcase and install the pump gasket and all mounting bolts.

(2) Install radiator (para 2-74c).

(3) Install fan belts on water pump pulley.

(4) Fasten radiator hose to water pump.

(5) Install the fan.

(6) Fasten the alternator bracket and adjust fan belt tension. See figure 2-85 for belt adjustment procedure and adjust belt tension.

(7) Fill the cooling system to the proper level with the correct coolant.

d. Service Water pump service consists of lubricating the pump shaft bearings in accordance with the current LO. At the same time, inspect the fan for bent or damaged blades. Replace the fan if necessary.

e. Guard Replacement. Refer to paragraph 2-74 and remove and replace damaged water pump fan guard.

f. Belt Adjustment and Replacement. Replacement of belts and belt adjustment are covered in paragraph 2-88.



Figure 2-85. Alternator and water pump belt tension adjustment, belt replacement, and alternator removal.

Section XXV. MAINTENANCE OF CRANE ELECTRICAL SYSTEM

2-87. General

The electrical system operates off a 24 volt supply. It is of the negative ground type. Refer to figure 1-4 for the crane wiring diagram. The system consists of two 12-volt batteries connected in series, a magnetic switch, a reverse polarity relay, an alternator with internal voltage regulator, the starter motor, the distributor and coil, ignition leads, and spark plugs, as well as the other minor components shown on the schematic diagram, figure 1-4.

WARNING

Always disconnect battery cables before working on electrical components.

2-88. Alternator

a. *General.* The alternator is a twin-belt drive, 24-volt, 60-ampere type with solid state

internally mounted rectifiers. It is designed for use with the reverse polarity protective relay described in paragraph 2-89d.

b. *Belt Adjustment.* Refer to figure 2-85 and adjust the alternator belt tension. Note that the alternator belts also drive the water pump, and that the water pump belt tension is being adjusted at the same time.

c. *Belt Replacement.* Refer to figure 2-85 and replace alternator-water pump belts.

d. *Alternator Testing.* Before removing an alternator for repair or replacement, belts, mounting bracket, and wiring must be inspected for slippage, fraying, broken wiring, grounds, or other faults. After these items have been checked and found in order, an electrical check may be made as follows.

(1) Remove the alternator terminal cover (fig. 2-85) to expose the positive (B+) terminal and check the voltage from this terminal to a

ground connection. Use an accurate voltmeter set on the 50-volt *dc* scale for this check. The ignition switch must be turned ON during this test. Full battery voltage of 24 volts should be shown. If no voltage is indicated, an open circuit between the battery and the alternator is indicated. Check battery cables, ignition switch, and wiring.

(2) With the ignition switch on, but the engine NOT started, check for full battery voltage from the ignition (IGN) lead of the alternator to ground. Full battery voltage must be indicated. It will be necessary to unplug the ignition (IGN) connector and check the male side with the voltmeter probe. Full battery voltage must be present at both alternator terminals in order for the machine to function properly.

CAUTION

Do not run the alternator with its output circuit open and the ignition lead energized. This will create extremely high voltages which will seriously damage the alternator. Never attempt to polarize this alternator. Always disconnect all alternator leads if welding is to be done on this unit.

e. Alternator Replacement. Refer to figure 2-85 and loosen alternator drive belts. Remove all electrical connections to the alternator. Support the alternator, remove the adjusting lock screw and remove the alternator mounting bolts, nuts, and lockwashers. Remove alternator. Install a new alternator and secure with mounting bolts, nuts, and lockwashers as shown in figure 2-85. Connect all electrical connections, and reinstall alternator-water pump drive belts. Adjust alternator-water pump belt tension as described in *b* above.

2-89. Starter Assembly

a. Starting Motor. The starting motor is designed for high torque, short use applications. It engages the flywheel ring gear, and is used to crank the engine until it starts. When the engine starts, the starter motor automatically disengages.

CAUTION

Never crank the engine for more than 30 consecutive seconds with the starter motor. If this does not start the engine wait at least two minutes before trying again.

(1) *Motor and solenoid test.* Before removing the motor make the following tests. Check the batteries (para 2-53) to make sure that the batteries are in good condition. Inspect all starting motor wiring for frayed insulation or other damage. Replace or repair damaged wiring. Inspect all connections to the starting motor, solenoid, magnetic switches, ignition switch, start pushbutton, and battery, including all ground connections. Clean and tighten defective connections. If the trouble is not found, connect a jumper wire around any switch or solenoid suspected of being defective. If the system functions properly using this method, replace the defective item. If none of the above has located the trouble, check the starting motor battery terminal, using a voltmeter adjusted for *dc* operation, and measure the battery voltage. If voltage is 22- to 24-volts, replace the starting motor.

(2) *Motor replacement.* Refer to figure 2-86 and remove and replace the starting motor.

b. Starting Motor Solenoid Replacement. Refer to figure 2-86 and remove the solenoid mounting capscrews. Refer to figure 2-87 and remove the starting motor solenoid.

c. Magnetic Switch Replacement.

(1) *General.* The magnetic switch shown in figure 2-88, sheet 2 is used to reduce the amount of current which must pass through the engine start switch. When energized, it energizes the starter solenoid, thus starting the engine.

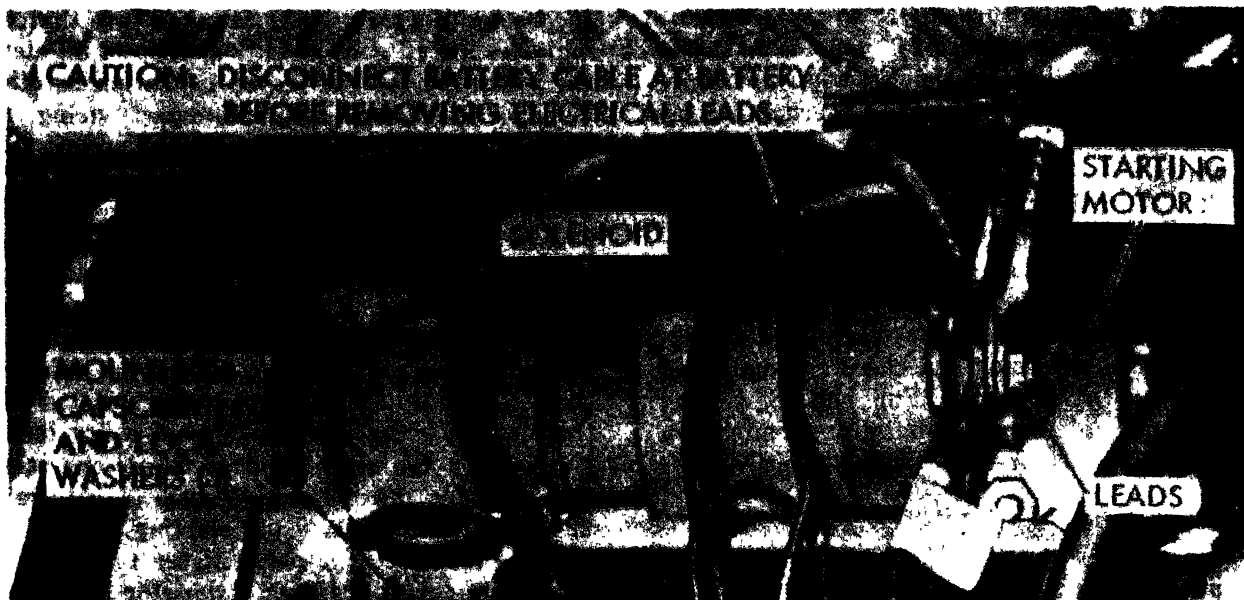
(2) *Removal.* Refer to figure 2-88, sheet 2 and remove electrical leads, two mounting screws, and lockwashers. Remove the magnetic switch.

(3) *Installation.* Position magnetic switch as shown in figure 2-88, sheet 2, install screws and lockwashers, and attach electrical leads.

d. Reverse Polarity Relay.

(1) *General.* The reverse polarity relay contains a solid-state rectifier which prevents current from flowing through the engine starting circuit in the wrong direction. Refer to the wiring diagram of the relay in figure 2-88 and the engine wiring diagram, figure 1-4.

(2) *Testing.* With the relay removed from the engine, connect a 24 volt source to connector C (fig. 2-88). Then touch the relay case to ground. The polarities shown on the diagram must be observed. When this is done, the relay will be energized, and an audible "click" can be heard when the relay contacts close. If the contacts close, the relay is in good condition. If not, replace the relay.



- STEP 1. DISCONNECT ALL ELECTRICAL LEADS.**
CAUTION: TAPE BATTERY LEAD IMMEDIATELY TO PREVENT SHORT CIRCUIT.
STEP 2. SUPPORT STARTING MOTOR AND REMOVE MOUNTING CAPSCREWS AND LOCKWASHERS.
STEP 3. REMOVE STARTING MOTOR.
STEP 4. INSTALL NEW STARTING MOTOR AND SECURE.
STEP 5. CONNECT LEADS TO MOTOR AND THEN TO BATTERY.

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Figure 2-86. Starting motor and solenoid removal and replacement.

(3) *Replacement.* Disconnect the three can-non-plug type electrical connections to the reverse polarity relay and remove the two mounting capscrews and lockwashers (fig. 2-88).

2-90. Ignition Components

a. Distributor Assembly.

(1) *General.* The distributor opens and closes the circuit between the low voltage source and the ignition coil so that the primary coil winding of the coil obtains intermittent surges of current. These surges build up magnetic fields around the primary coil. When the surge of current stops as the points open, the collapse of the magnetic field induces a high voltage surge in the coil secondary winding. This high voltage surge is directed to the spark plugs to ignite the fuel. The distributor also is used to time these surges of spark plug power for most efficient engine operation.

(2) Removal.

(a) Stop the engine and disconnect battery cables.

(b) Disconnect the coil-to-distributor cable at the coil end. See figure 2-89.

(c) Loosen the two screws and remove the distributor cap.

(d) Refer to figure 2-56 and disconnect the tachometer drive cable.

(e) Disconnect the primary cable from the side of the distributor housing.

(f) Remove manual advance arm locking bolt and lift out the distributor.

b. Point and Condenser Replacement. Refer to figure 2-89. Note that points and condensers can be replaced before reinstalling distributor.

(1) Remove distributor cap.

(2) Remove rotor as shown in figure 2-89.

(3) Remove adjusting screw.

(4) Remove the condenser by removing attaching screw.

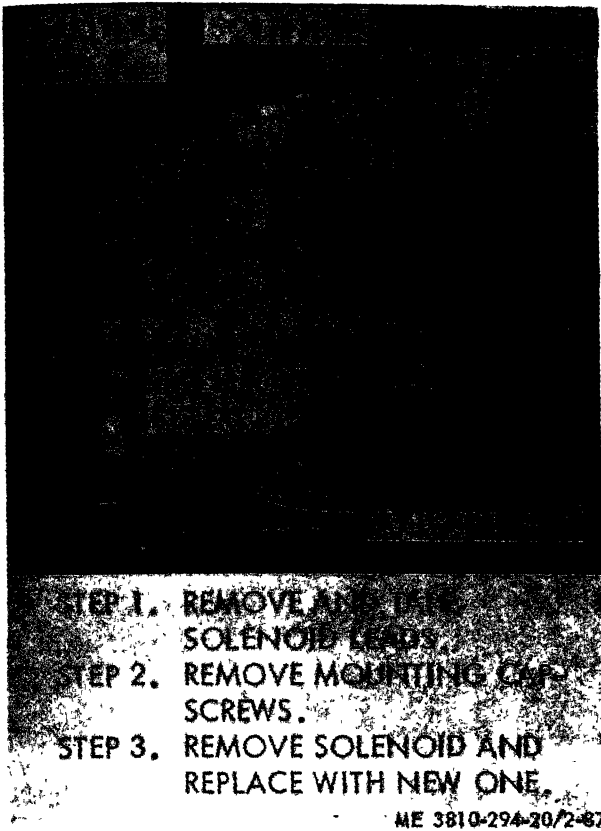


Figure 2-87. Starting motor solenoid removal and replacement.

(5) Install new condenser and points, and adjust breaker points as follows: Turn the distributor shaft so that breaker arm rubbing point is on the high point of the breaker cam. Turn adjusting screw slightly until breaker point clearance is 0.022 inch, as measured by a round feeler gage. Tighten adjusting screw.

(6) Turn distributor shaft so breaker points are closed. Inspect breaker point alignment. Bend fixed point bracket so that points are aligned for full face contact. Recheck point gap and readjust if necessary.

(7) Install rotor.

c. Distributor Replacement and Adjustment.

(1) Wipe the cap and be sure all parts are clean and dry. Do not use degreasing compounds.

(2) Turn the engine crankshaft over to place the number one piston on top dead center of the compression stroke as shown in figure 2-80.

(3) Refer to figure 2-89 and place a drop of OE lubricating oil on the felt lubricant wick.

(4) Install the distributor in position on the engine. Be sure the distributor shaft tang engages the drive properly. Do not secure the manual advance (fig. 2-89) at this time.

(5) Place the distributor cap on the distributor and turn it until it drops into place. It will fit in only one position. Do not secure it with spring clips at this time.

(6) Trace the number one spark plug wire to its terminal in the cap. Raise the cap and determine if the rotor aligns with this same terminal. If the rotor does not align with this terminal, but instead aligns with the number six terminal, raise the distributor, disengaging the shaft tang, and rotate the shaft and rotor 180 degrees. Lower the distributor into the support again. This time install the advance arm lock-screw and secure finger tight.

(7) Be certain that the distributor cap is properly located on the distributor housing and that both mounting screws are tight.

CAUTION

If the distributor cap is incorrectly positioned on the distributor housing, it will usually result in a broken rotor when attempting to start the engine. The firing order is 1-5-3-6-2-4; and spark plug cables must be assembled in the distributor cap in this order in clockwise rotation as viewed from above the distributor.

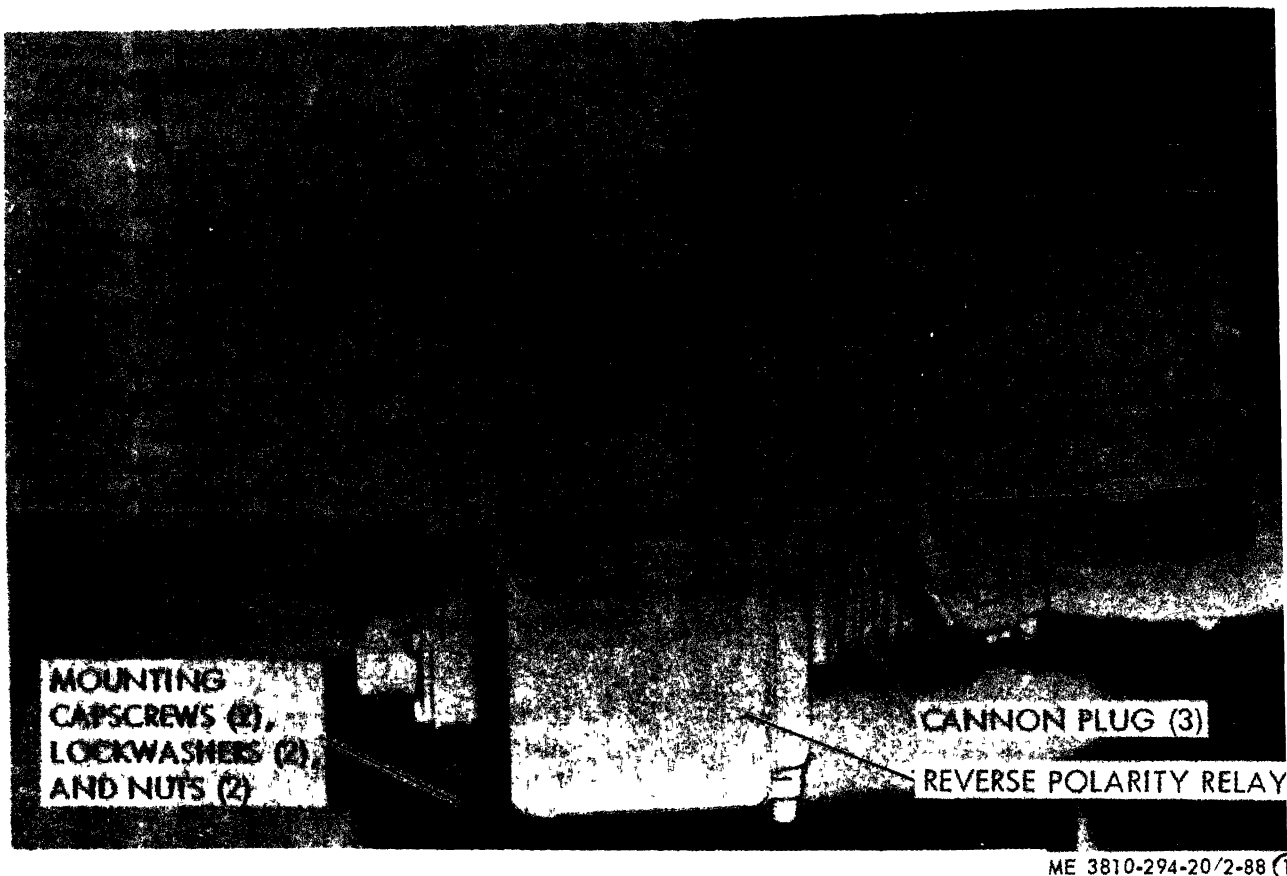
(8) Disconnect the distributor vacuum advance line at the carburetor and close the fitting with a piece of tape.

d. Distributor Timing.

(1) Connect a stroboscopic timing light to the No. 1 spark plug. Some timing lights required connecting one lead to the spark plug terminal and the other to ground (parallel connection). Others require disconnecting the spark plug wire and connecting one of the timing light wires to the spark plug wire and the other wire to the spark plug terminal (series connection). Use white chalk to highlight the timing mark, figure 2-90.

(2) Start the engine and notice if the timing light is flashing. Each light flash should be fast and accurate, and the timing marks should be readily seen.

(3) When the engine is thoroughly warmed up and running at low idle speed (475-525 rpm), direct the timing light to the timing location on the fan drive pulley. The light should



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Figure 2-88. Reverse polarity relay and magnetic switch, testing, removal, and replacement (Sheet 1 of 2).



Figure 2-88. Reverse polarity relay and magnetic switch, testing, removal, and replacement (Sheet 2 of 2).

flash at zero degrees (top-dead-center) to four degrees advance. See figure 2-90.

(4) Depending on the application and type of fuel used, the timing may be varied to obtain the best engine performance. When varying distributor timing, care must be taken to prevent detonation occurring at any phase of engine operation. Do so as follows.

(5) Loosen the manual advance locking bolt, figure 2-89, sufficiently to permit rotation of the distributor housing until the timing mark is in alignment with the pointer or quadrant.

NOTE

Moving the arm counterclockwise advances the spark. To retard the spark, move the arm in the opposite direction.

(6) Tighten the adjusting clamp screw and recheck to be certain that tightening the screw did not disturb the timing adjustment.

(7) Connect the distributor vacuum advance line to the carburetor.



Figure 2-89. Distributor assembly removal, replacement and timing. (Sheet 1 of 2)

(8) The timing of the spark depends on the breaking of electrical contact at the breaker points. To assure accurate timing, make up a simple light circuit consisting of a 24 volt automotive light bulb with soldered-on leads or a socket with leads attached as shown in figure 2-91. Clip one lead to the lead to the movable breaker point and attach the other lead to ground. Turn the engine to TDC on the compression stroke for number one cylinder using timing marks shown in figure 2-90. Turn the ignition switch to the ON position. Rotate the distributor body (fig. 2-89) slightly to determine the point of breaker point opening, which will be the point where the light turns on. Tighten the hold down screws at the base of the distributor, making sure the body does not turn further. Reinstall distributor cap.

(9) Connect the distributor vacuum advance line to the carburetor.

2-91. Ignition Coil and Spark Plugs

a. General. The ignition coil has primary and secondary windings. The low voltage (24 volt) pulses from the distributor go to the primary

winding, where they cause a magnetic field to develop. When the distributor points open, this field collapses, inducing a very high voltage in the secondary winding. This high voltage is conducted to the engine spark plugs, via the high tension leads, to ignite the fuel in the combustion chamber.

b. Coil Testing. If a distributor ignition coil is thought to be defective, refer to figure 2-92 and disconnect electrical connections to the coil. Then test as follows.

(1) Check the continuity of the coil primary by connecting an ohmmeter across the primary terminals. The ohmmeter reading should be very low.

(2) Check the continuity of the coil secondary by connecting an ohmmeter across one primary terminal and the secondary terminal. The ohmmeter reading should be high.

(3) If no reading or an infinite reading is obtained, the coil is open or shorted, and should be replaced.

c. Coil Replacement. Remove the mounting screws, disconnect all electrical connections, and replace the ignition coil. Refer to figure 2-92.

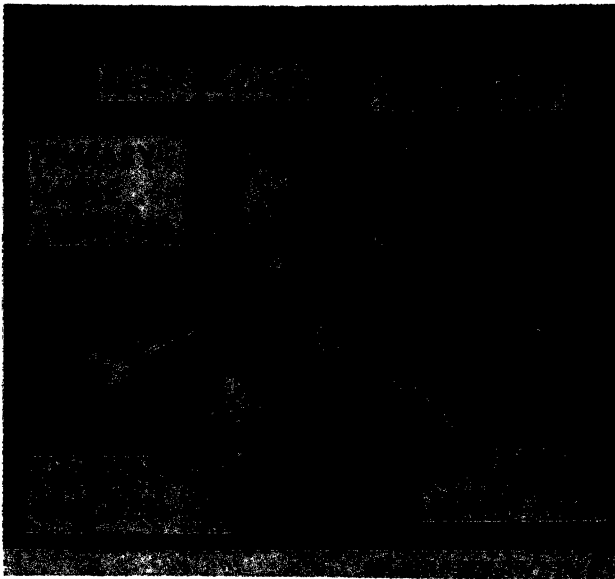


Figure 2-89. Distributor assembly removal, replacement, and timing. (Sheet 2 of 2)

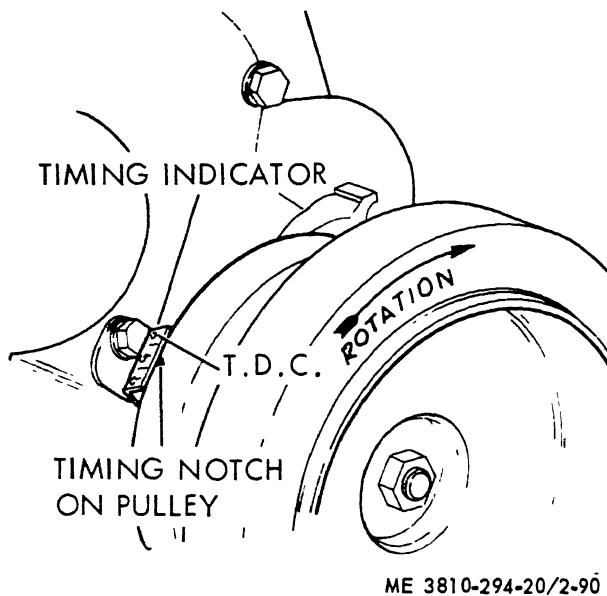
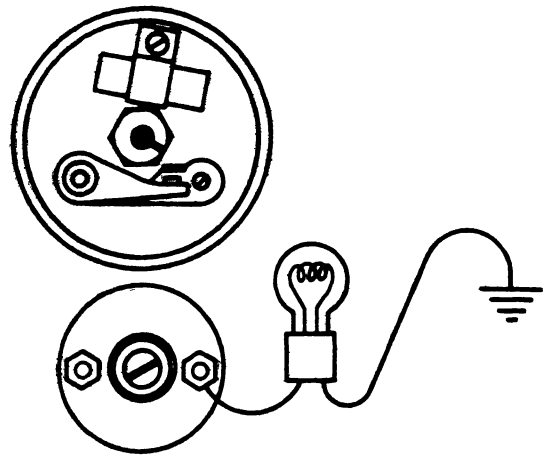


Figure 2-90. Ignition timing mark alignment.

NOTE

Always replace spark plugs, points, and condenser at the same time.

d. **Spark Plug Removal.** Unscrew the shielded ignition leads at the top of the spark plugs and place a deep socket spark plug wrench on the spark plug hexagon. Unscrew spark plugs and



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Figure 2-91. Use of distributor timing light.

remove. Be careful not to lose the metal gasket beneath the spark plug.

e. **Spark Plug Testing and Adjustment.** Inspect spark plugs for obvious cracks, broken or severely worn points, pitting, discoloration, or accumulations of foreign material. Discard a spark plug not in good apparent condition. If available, install the plugs in a spark plug tester and check for adequate performance. Gap the spark plugs to a clearance of from 0.029- to 0.030-inch. Use a round feeler gage in preference to a flat gage, since a flat gage will give incorrect readings.

f. **Spark Plug Installation.** Install spark plug and metal gaskets and tighten plugs finger tight. Then tighten them to 28- to 30-foot pounds, using a torque wrench, if available. If not available, snug the plugs down firmly. Do not overtighten as you may ruin threads in bore.

2-92. Suppression Leads

a. **Removal.** Refer to figure 2-92 for a view of the suppression leads. These leads are from the distributor to the spark plugs and to the coil. The leads are removed by unscrewing them at the distributor and the individual spark plugs.



Figure 2-92. Ignition coil, testing, removal, and replacement.

b. Test. Connect suppression lead to positive side of any battery. Place the tip of a light bulb on the negative terminal. Hold the other end of this lead against the metal side of the light bulb. If the light bulb illuminates, the lead is at least not an open circuit, and may be fit for further use. If the light does not come on, replace the lead. If an ohmmeter is available, the lead should test about 2,000 ohms per inch of length.

2-93. Sending Units

a. General. The sending units and associated lights and switches provide visual indications of developing trouble.

b. Oil Temperature Switch. Refer to figure 2-93. Disconnect electrical lead. Drain oil below the level of the switch, then unscrew and replace a faulty oil temperature switch.

c. Water Temperature Sender. Open radiator drain cocks and drain coolant level below the level of the water temperature sender. Then refer to figure 2-94; disconnect electrical leads and unscrew and replace the water temperature sender.

d. Oil Pressure Sender. Drain engine oil below the level of the pressure sender. Refer to figure 2-95; disconnect electrical leads and unscrew and replace a faulty oil pressure sender.

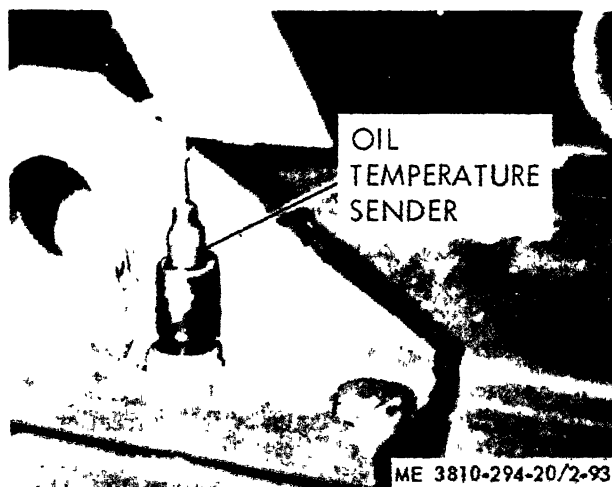


Figure 2-93. Oil temperature sender, removal and replacement.

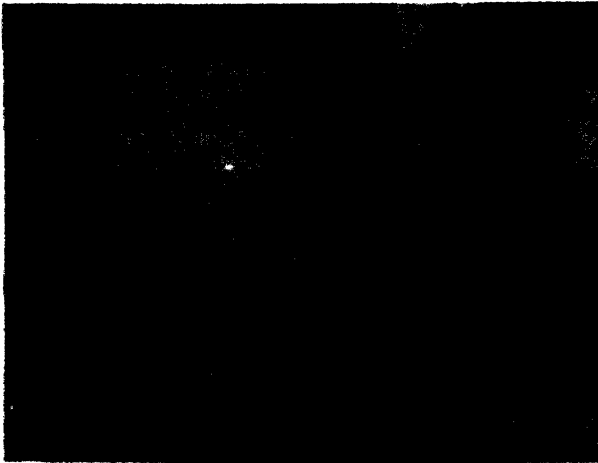


Figure 2-94. Water temperature sender, removal and replacement.

Figure 2-95. Oil pressure sender, removal and replacement.

Section XXVI. MAINTENANCE OF CRANE ENGINE ASSEMBLY AND MECHANICAL ACCESSORIES

2-94. General

a. This section contains organizational maintenance instructions for service, test, and maintenance of the engine assembly as allocated by the maintenance allocation chart, appendix B.

b. Engine mechanical accessories include the rocker arm assemblies which open and close the valves; the intake and exhaust manifolds which provide fresh air for combustion and exhaust burned fuel; the tachometer and drive which measures and displays engine speed; the engine clutch which engages and disengages the engine from the drive train.

exceed 10 psi between the highest and lowest reading per cylinder at normal cranking speed. Compression will deviate considerably from specifications due to crank speed, altitude, and ambient temperature. The specifications listed in paragraph 1-7 b(2) are to be used as a basic guide.

NOTE

The best indication of valve or ring leakage is to detect those cylinders not conforming to the allowable 10 psi variation.

2-95. Crane Engine Service and Test

a. *Service.* Clean, inspect and lubricate the crane engine in accordance with instructions in LO 5-3810-294-12/4.

b. *Compression Test.* A compression check must be made with all spark plugs removed, the throttle wide open and the engine air cleaner removed. Compression should be uniform, not to

2-96. Crankcase Inspection and Service

a. *Inspection.* Remove the engine oil dipstick figure 2-96, wipe it dry with a clean lint free cloth, reinsert it in the dipstick opening, and withdraw it. If oil level is below the FULL mark, servicing is required. Inspect the crankcase oil pan to see that no leaks are apparent and that the pan is not damaged.

b. *Service.* Pour the necessary amount of lubricant of the type shown in the current LO into



Figure 2-96. Checking and servicing engine oil pan.

the engine crankcase to bring the oil level to the FULL mark on the dipstick. Always shut the engine down for a few minutes before checking oil level. This will allow oil in the engine to return to the crankcase. Refer to figure 2-97 and drain the lubricating oil from the crankcase at the intervals prescribed in the current LO.

2-97. Rocker Arm/Tappet Inspection and Adjustment

a. *General.* Rocker arm adjustment is required when tappet noise increases noticeably. Basically, it is the clearance between the valve stem and the rocker arm which is adjusted.

b. *Adjustment.*

(1) Disconnect the high tension cable between the distributor cap and the coil, at the oil.

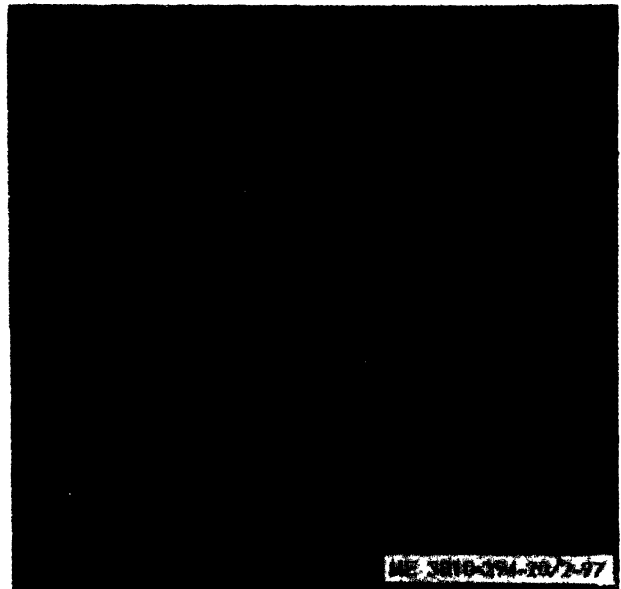


Figure 2-97. Draining engine oil pan.

(2) Remove the valve housing cover, figure 2-98.

(3) The piston must be on top dead center when adjusting valve stem to rocker arm clearance for that piston. Turn the crankshaft to place number one piston on top dead center, compression stroke. See that the ignition timing mark on the flange of the fan drive pulley is lined up with the timing pointer on the crankcase front cover as shown in figure 2-90.

(4) Refer to figure 2-99 and loosen the adjusting screw locknut on both the number one intake and exhaust valve levers.

(5) Adjust to the clearances shown in figure 2-99 using a feeler gage.

(6) Tighten both locknuts and recheck the clearances with the feeler gage.

(7) Crank the engine one third of a crankshaft revolution (120°) at a time, in the direction of normal rotation, and set the valve clearances for each cylinder in firing order sequence, which is 1-5-3-6-2-4.

(8) Replace the valve housing cover. Use a new cover gasket if necessary to obtain an oil tight seal.

(9) Reinstall the high tension cable on the ignition coil.

NOTE

Valve clearances must be correct or the valves will fail to rotate normally, which may cause premature exhaust valve failures.

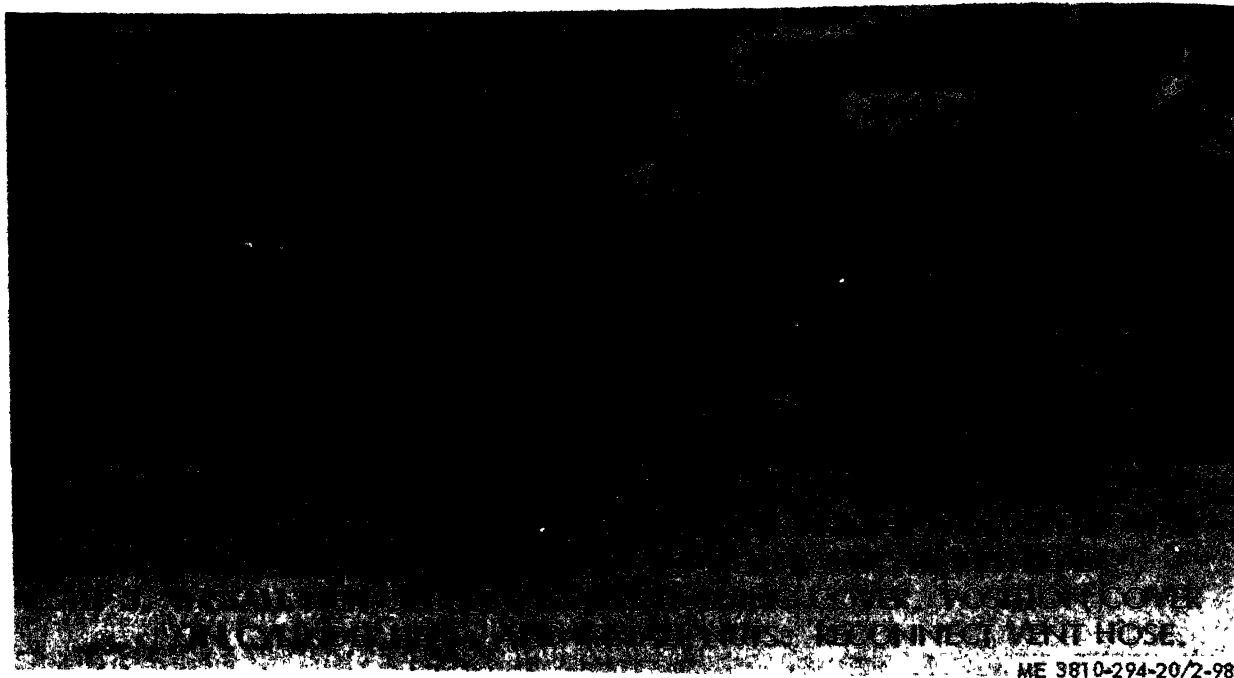


Figure 2-98. Valve housing cover, removal and replacement.

2-98. Engine Lubricating System

a. *General.* The engine lubrication system consists of the supply of oil contained in the engine crankcase, the oil pump, filters, tubing, temperature sensing device, the dipstick, and the openings in the crankcase through which oil is added or drained. The system is designed to provide adequate oil lubrication of moving parts and to assist in cooling the engine.

b. *Engine Full-Flow Oil Filter.* The full-flow oil filter (fig. 2-100) uses a paper element to filter oil entering the engine oil passages from the oil pump. The oil filter base contains three valves.

(1) The pressure regulator (high pressure) valve controls maximum oil pressure in the system as 50-55 psi. Oil relieved by the regulator valve is directed back into the oil pan.

(2) The filter bypass (low pressure) valve permits oil to bypass the filter if the filter element becomes clogged, thereby maintaining a supply of oil to the engine.

NOTE

Oil pressure in the main oil gallery is determined by the pressure regulator valve less the oil pressure drop through the filter element. Appropriate pressure drop with a new element is 1-

to 2-psi. As element becomes clogged, oil gallery pressure continues to drop until 12-15 psi difference in pressure is reached. At this point, low pressure (bypass) valve permits the oil to bypass the filter element and enter the engine oil gallery unfiltered. The high pressure (pressure regulator) valve and the low pressure (bypass) valve can be identified by the letters "H" and "L" adjacent to the valve bores in the filter base.

(3) The third valve bypasses the oil cooler if the cooler becomes clogged, in the same manner described in (2) above. It is not marked, but it can be identified by its inverted position in relation to the other valves.

(4) Refer to figure 2-100 for service and replacement of the full-flow oil filter.

c. Oil Cooler and External Oil Lines.

(1) *General.* The engine oil cooler is mounted on the left side of the engine and is connected to the oil filter base. Engine oil is circulated from the crankcase through the cooler and into the oil filter.

(2) Oil cooler removal.

(a) Drain the cooling system, oil cooler, and oil filter.

(b) Remove the ignition coil (para 2-91).

(c) Disconnect the water pump-to-oil cooler pipe at the oil cooler. See figure 2-101.

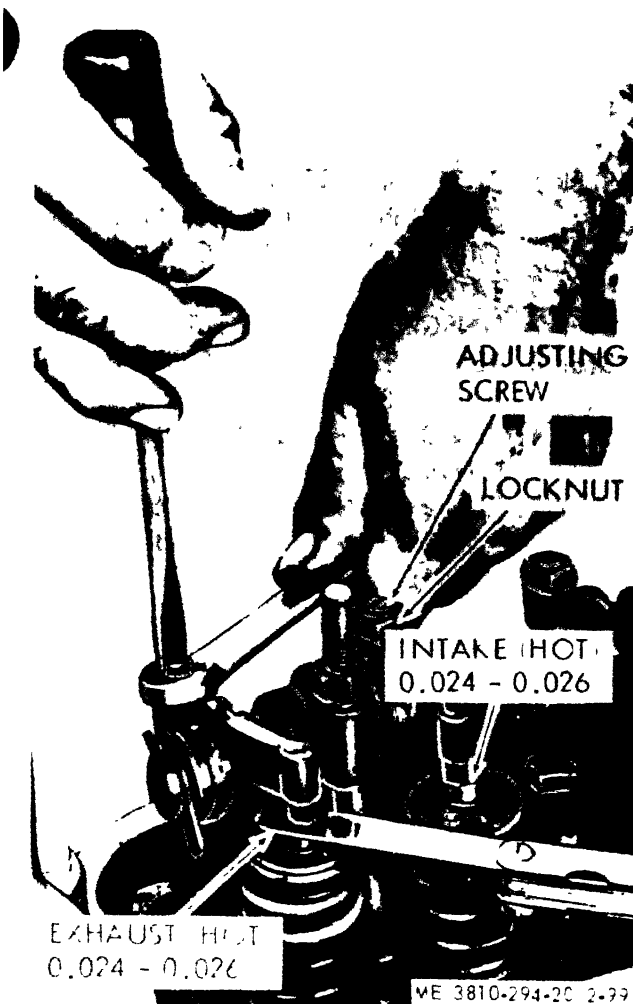


Figure 2-99. Adjusting valve stem to rocker arm clearance.

(d) Disconnect the upper oil cooler pipe from the oil cooler.

(e) Disconnect the lower oil cooler pipe from the oil filter base.

(f) Remove the brackets at the upper end of the oil cooler.

(g) Remove the capscrews securing the lower end of the oil cooler to the crankcase. Remove the oil cooler.

(3) *Oil cooler service.* Immerse the oil cooler into a cleaning solvent to loosen sludge and foreign matter with compressed air. Be sure all passages are clean before replacing on engine.

NOTE

Improper maintenance of the cooling system or oil system are the most probable reasons for poor oil cooler performance.

(4) *Oil cooler replacement.* Refer to figure 2-101 and install the oil cooler as follows:

(a) Fasten the oil cooler to the engine. Bolt the bottom end to the crankcase and install the brackets at the top.

(b) Using a new gasket, fasten lower oil cooler pipe to the oil filter base.

(c) Using a new gasket, fasten the upper oil cooler pipe to the oil cooler.

(d) Connect water pump-to-oil cooler pipe to oil cooler.

(e) Install the ignition coil (para 2-91).

(f) Fill the cooling system.

(g) Fill the crankcase to the correct level.

(h) Run the engine for about ten minutes, stop the engine, and inspect for oil or water leaks.

d. *External Line Service and Repair.* The only repair possible for external oil lines is replacement of damaged lines or flange gaskets, and tightening loose connections. Refer to figure 2-101.

e. *Replacement.* Refer to figure 2-101 and replace any unserviceable parts.

2-99. Intake and Exhaust Manifolds

a. *General.* Intake and exhaust manifolds (fig. 2-102) provide fresh air for combustion and exhaust burned fuel.

b. *Inspection.* Inspect manifolds for cracks, breaks, signs of deterioration of gaskets, warping, or gas leaks.

c. *Removal.* Remove the exhaust manifold as follows:

(1) Stop engine. Refer to figure 2-80 and remove all throttle, choke, and other connections to the carburetor. Remove the carburetor.

(2) Refer to figure 2-72 and disconnect air hose from air cleaner to intake manifold.

(3) Disconnect the breather tube from the intake manifold, figure 2-102.

NOTE

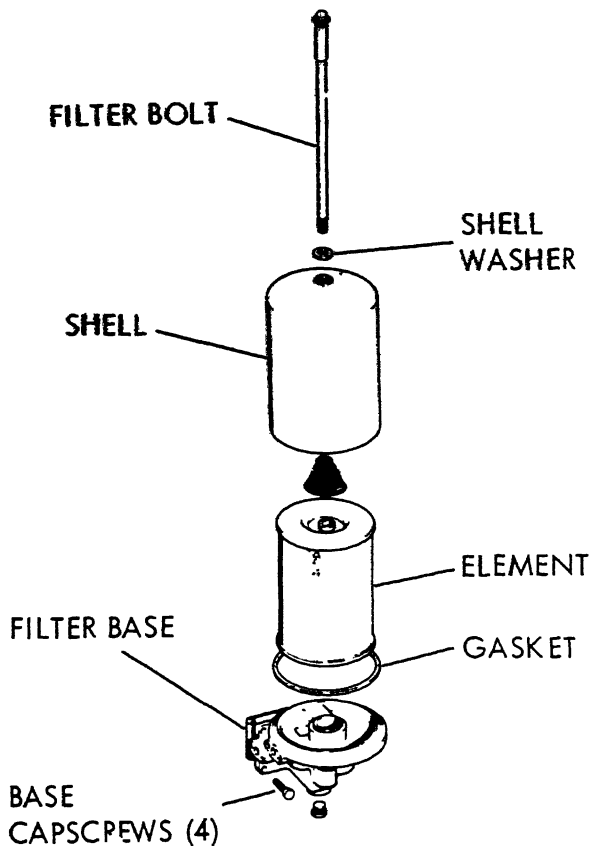
Allow manifolds to cool before removal.

(4) Remove all capscrews fastening manifolds to cylinder heads and remove both the intake and exhaust manifolds from the engine. See figure 2-102.

(5) Remove capscrews which connect the two manifolds at the center and separate them. Separate the exhaust manifold into three parts by removing two expansion clamps.

d. *Replacement.*

(1) Refer to figure 2-102 and assemble intake and exhaust manifolds together using a



- STEP 1. STOP ENGINE. REMOVE DRAIN PLUG AND DRAIN OIL INTO SUITABLE CONTAINER.
- STEP 2. UNSCREW FILTER BOLT.
- STEP 3. REMOVE SHELL, WIPE CLEAN, AND REPLACE ELEMENT.
- STEP 4. REMOVE GASKET AND BASE GASKET.
- STEP 5. REMOVE BASE CAPSCREWS TO REMOVE ENTIRE ASSEMBLY.
- STEP 6. REASSEMBLE BOLT, SHELL, ELEMENT AND BASE. INSTALL DRAIN PLUG.
- STEP 7. INSTALL ASSEMBLY USING BASE CAPSCREWS AND NEW BASE GASKET.

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Figure 2-100. Full-flow oil filter, service and replacement.

new gasket and new capscrews. Do not assemble the end sections of the exhaust manifold to the center section at this time.

(2) Assemble the intake and center section of the exhaust manifold loosely to allow for proper alignment when installed.

(3) Install the manifold to the cylinder head, using new gaskets, capscrews, and lockwashers.

(4) Assemble the clamp gasket, expansion clamp, and the end sections of the exhaust manifold. Now tighten the four capscrews that fasten the two manifolds together.

(5) Install the exhaust pipe flange sealing plate and gasket to the exhaust manifold.

(6) Install the carburetor and connect the choke wire.

(7) Connect the throttle control rod.

(8) Connect the crankcase breather tube to the intake manifold.

(9) Replace the alternator heat shield.

2-100. Tachometer Drive

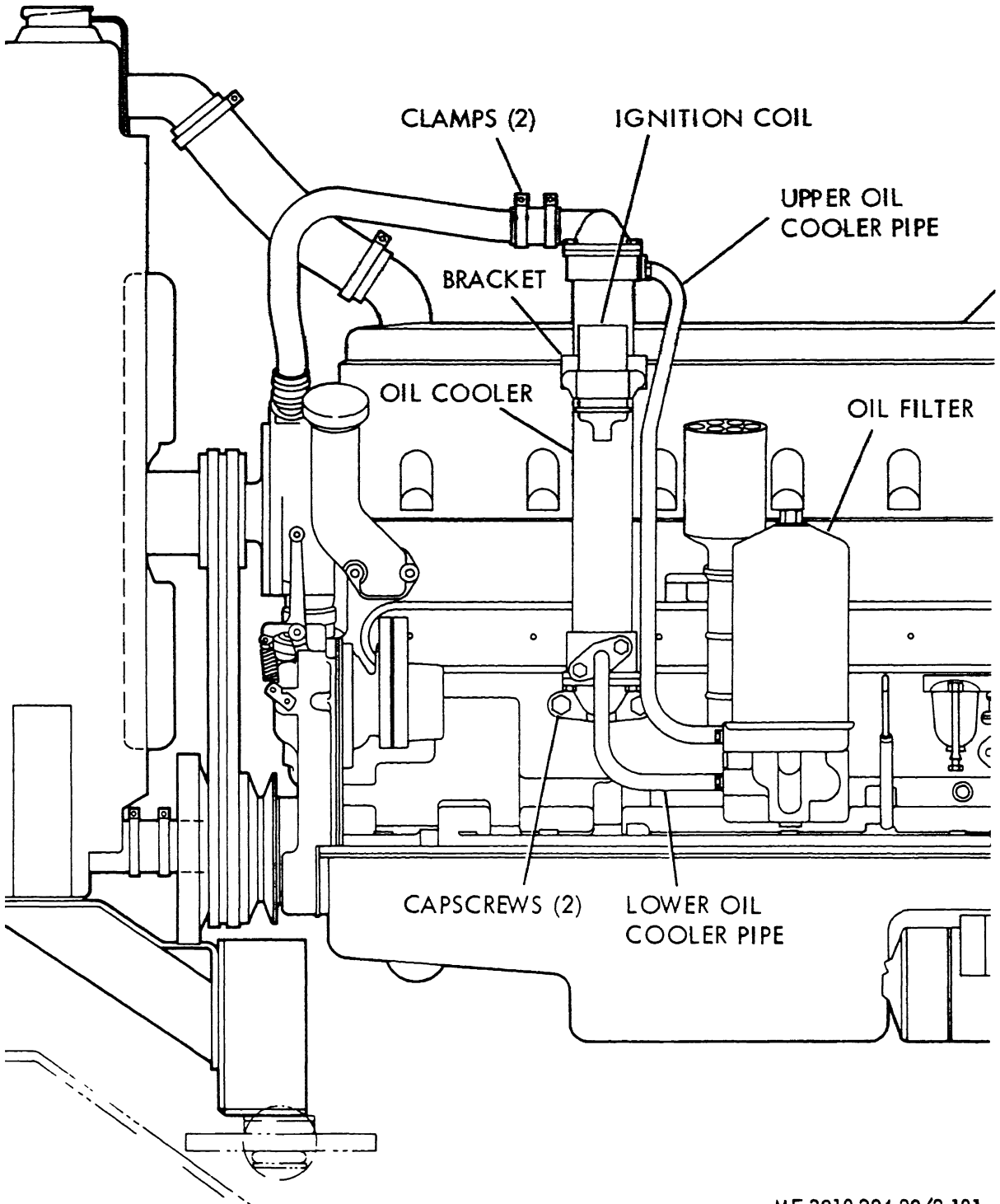
a. General. The tachometer-hour meter is mounted on the operator's control panel. See figure 2-54. It is cable driven from the tachometer drive, figure 2-56.

b. Tachometer Drive Removal and Replacement. Refer to figure 2-56 and disconnect the tachometer drive cable from the connector on the distributor shaft. Disconnect the cable from the tachometer-hour meter and remove the cable. Install by connecting drive cable to connectors.

2-101. Engine Clutch

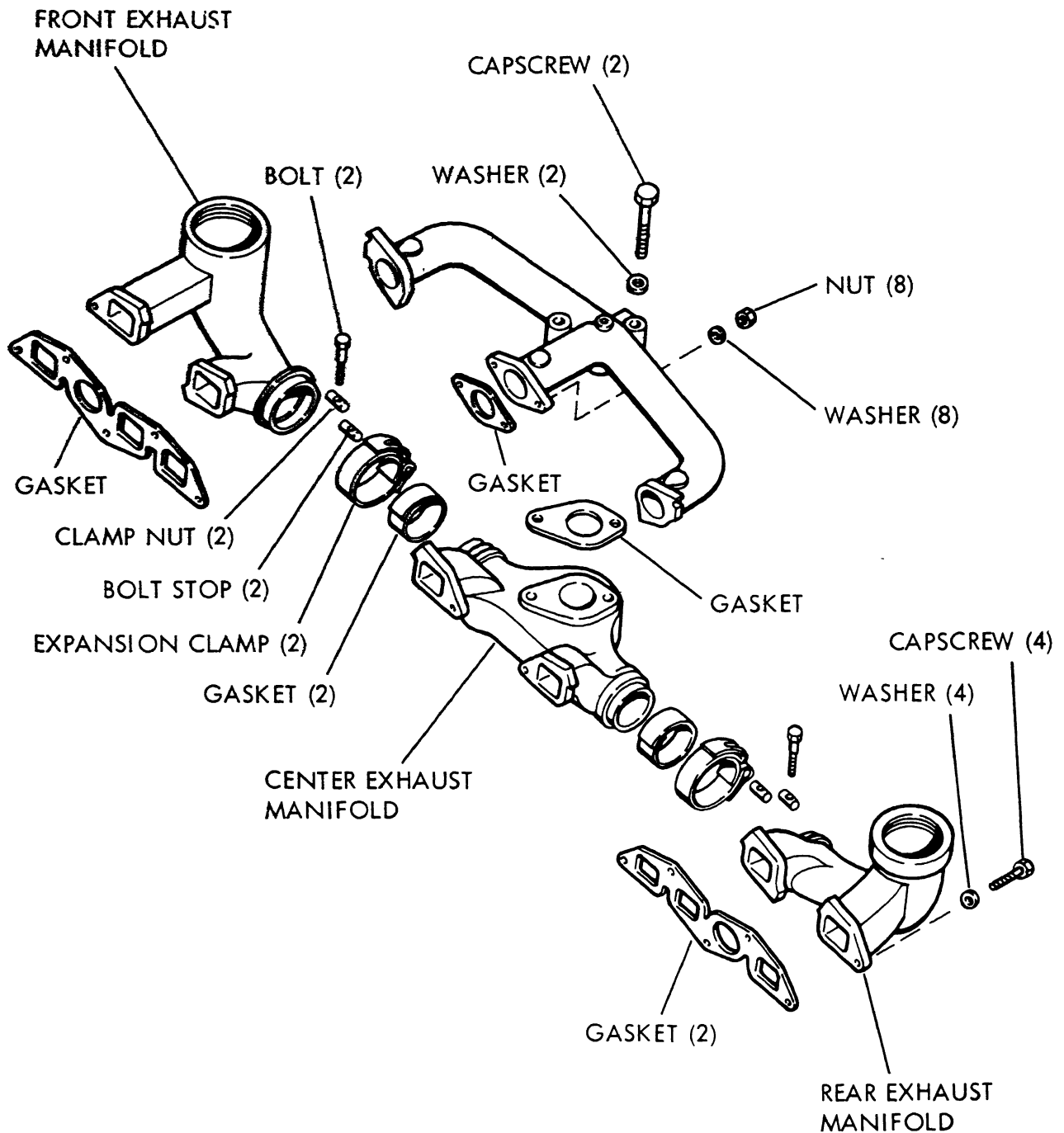
a. General. The engine clutch is engaged and disengaged by a lever in the operator's cab. It is an over center adjustable type.

b. Inspection. Place a spring scale on the engine clutch lever in the operator's cab and pull the lever back from the disengaged to the engaged position. It should require between 42-



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Figure 2-101. Oil cooler and external oil lines removal and replacement.



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Figure 2-102. Intake and exhaust manifolds, removal and replacement.

and 44-pounds of steady pull to engage the clutch. If substantially more or less pull is required, the clutch must be adjusted. Inspect the clutch housing for signs of leaks or damage.

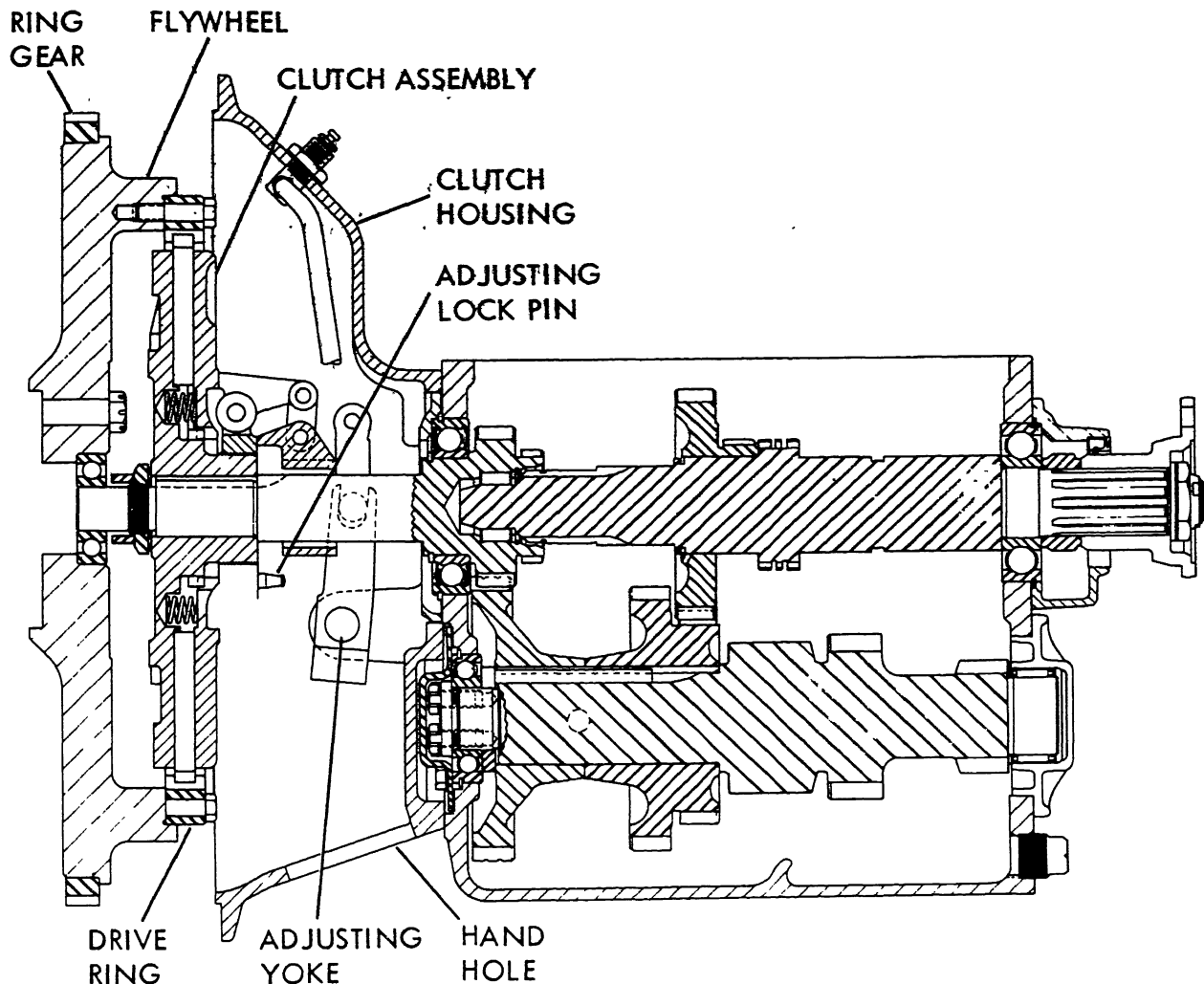
c. *Adjustment.* Adjust the clutch as follows:
 (1) Remove the hand hole cover, figure 2-103, and disengage the clutch using the operator's lever.

(2) Pull the adjusting lock pin outward, using a suitable tool, and turn the adjusting yoke inward.

(3) Periodically check the pull required to

engage the clutch at the operator's lever. Adjust so that 42-to 44-pounds pull is required to engage the clutch.

(4) Replace the clutch hand hole cover.



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Figure 2-103. Engine clutch adjustment.

Section XXVII. MAINTENANCE OF SHOVEL AND EARTH WORKING EQUIPMENT

2-102. General

In every case where clutches or brake bands are to be removed or replaced, safety requires that the load being supported by that clutch or brake be lowered to the ground. Specifically, always lower the boom to the ground when the boom hoist clutch or brake are to be worked upon. Lower the loads to the ground before working

on front or rear drum brakes or clutches. Secure the revolving frame from turning before working on the swing brake, swing brake lock, or anti-rotation device. Always lower attachments, including shovel fronts, backhoe fronts, clamshell and dragline buckets, booms and jibs, and piledriver or magnets to the ground or to proper supports to prevent any possible injury to personnel or damage to the machine.

2-103. Engine Clutch Shaft Service

Lubricate the engine clutch shaft in accordance with LO 5-3810-294-12.

2-104. Chain and Sprocket Adjustment

a. Shovel Crowd Chain Adjustment. Adjustment procedures for the shovel crowd chain are covered in paragraph 2-26b (2) and figure 2-24.

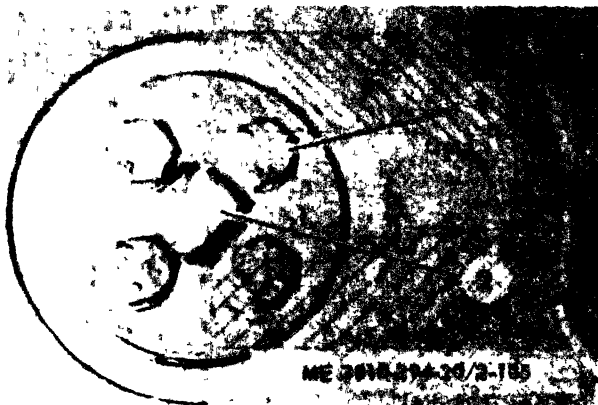
b. Reversing Shaft Chain Adjustment.

(1) Refer to figure 2-105 to locate reversing shaft chain eccentric shaft wrench block.

(2) Loosen four capscrews (1, fig. 2-105). total midspan chain slack is between 1/4-and

(3) Tighten wrench block (2) until the total midspan chain slack is between 1/4 and 3/8-inch.

(4) Tighten the four capscrews.



1. Capscrew

2. Block

Figure 2-105. Chain case.

c. Rear Drum Chain Adjustment. Repeat steps (1) through (4) in *b* above.

NOTE

Total midspan chain should be approximately 1 2 inch

d. Horizontal Swing Shaft Chain Adjustment. Repeat *c* above to adjust the horizontal swing shaft chain.

2-105. Rear Drumshaft Brake and Clutch

a. General. Always adjust a brake or clutch which has been removed before returning the machine to operation. The rear drum-shaft brake is used to hold the load on the rear drum load

line. The clutch engages the load to the drum.

b. Adjust. Refer to figure 2-106 and place the rear drum clutch lever in the center (neutral) position. Refer to figure 2-107 and adjust the rear drum clutch. Position the clutch as desired by "tapping" the engine start pushbutton, with the ignition switch in the OFF position.

c. Brake Band Replacement. Refer to figure 2-108 and remove or replace the rear drum brake band.

d. Clutch Band Replacement. Refer to figure 2-109 and remove or replace the rear drumshaft clutch band. Position the band as required by "tapping" the engine start pushbutton.

2-106. Front Drumshaft Brake and Clutch

a. General. Always adjust a brake or clutch which has been removed before returning the machine to service. The front drum-shaft brake bands and clutch bands are adjusted, removed, and replaced in the same manner as the rear drumshaft brake and clutch. The only difference is that the front drumshaft clutches are assembled reversed, since the drumshafts turn in opposite directions.

b. Adjust. Adjustment of this clutch is identical to the adjustment of the rear drum clutch, except that the front drum clutch lever instead of the rear drum clutch lever (fig. 2-106) must be placed in the center (neutral) position. Refer to figure 2-107 and adjust the front drum clutch. Position the clutch as desired by starting the engine and momentarily engaging the engine clutch.

c. Brake or Clutch Band Replacement. Refer to figures 2-108 and 2-109 and replace front brake or clutch bands.

2-107. Reversing Shaft and Horizontal Swing Shaft Clutches

a. General. The reversing shaft clutch and the two horizontal swing shaft clutches are all identical in appearance and in removal and replacement procedures.

b. Adjust. Refer to figure 2-106 and place the control lever for the clutch being adjusted in the center (neutral) position. Refer to figure 2-110 and adjust the reversing shaft clutch or the horizontal swing shaft clutch.

NOTE

Both swing clutches and the reversing shaft clutch are identical.

c. Replacement. Refer to figure 2-111 and remove or replace a reversing shaft or horizontal swing shaft clutch.

2-108. Boom Hoist Brake and Clutch

a. General. The boom hoist brake is spring set-hydraulically released. Always lower the boom to the ground before adjusting or working on the brake or clutch.

b. Brake Band Removal.

(1) Refer to figure 2-125 and remove the boom hoist planetary pawls.

NOTE

The boom hoist brake band is removed as an assembly.

(2) Refer to figures 2-112 and 2-113 for views showing the band assembled. To remove the assembly, remove items 1 through 7 of figure 2-114. The entire assembly can then be removed to the bench for complete disassembly as shown. Unscrew the threaded end of the lower brake band from the adjusting rod to complete removal of the brake bands. Note that the phantom pin on figure 2-114 is welded to the revolving frame side frame and can not be removed.

c. Brake Adjustment. Refer to figure 2-112 and adjust the boom hoist brake. Be careful to prevent grease or other lubricant from contacting brake linings at any time.

WARNING

Always lower the attachment to the ground before attempting to adjust the boom hoist brake. Serious damage to the equipment or death or injury to personnel may otherwise result.

d. Clutch Removal and Replacement. Refer to figure 2-113 and remove or replace the boom hoist shaft clutch.

e. Clutch Adjustment. Refer to figure 2-106 and place the boom hoist clutch lever in the center (neutral) position. Refer to figure 2-115 and adjust the boom hoist clutch.

2-109. Swing Brake

a. General. The swing brake is used to hold the revolving frame from turning while the machine is being transported, or when it is desired to prevent the frame from turning. It is not used to stop the frame once it is in motion.

b. Replacement of Brake Shoes. Refer to figure 2-116 and remove or replace swing brake shoes. Engage the swing brake mechanical lock (para. 2-115) to prevent the frame from turning.

c. Service. Keep the mechanical components of the swing brake clean. Lubricate in accordance

with LO 5-3810-294-12. Keep locknuts tightened.

d. Adjust. Refer to figure 2-106 and place the swing brake lever in the released position. Refer to figure 2-117 and adjust the swing brake.

2-110. Drive Chains Replacement

a. General. The removal and replacement procedures for each drive chain are given in the following paragraphs.

b. Reversing Shaft Chain. Refer to figure 2-11 and remove the reversing shaft chain.

c. Rear Drum Chain. Refer to figure 2-119 and remove the rear drum chain case. Refer to figure 2-120 and remove the rear drum chain.

d. Horizontal Swing Shaft Chain. Refer to figure 2-121 and remove the horizontal swing shaft chains.

e. Shovel Crowd Chain. Refer to paragraph 2-28 for replacement of shovel crowd chain.

2-111. Hook Rollers

a. General. Hook rollers are provided to prevent the crane from tipping in relation to the truck. This prevents damage to the machine, while improving machine stability.

b. Removal. Refer to figure 2-122 and remove hook rollers. There is a single hook roller at the front of the revolving frame as shown in figure 2-122. A double hook roller of identical design is used at the rear of the revolving frame. Removal and replacement procedures are the same.

c. Adjustment. Refer to figure 2-123 and adjust hook rollers if clearance between rollers and roller path exceeds 1/16 inch. Items shown in figure 2-122 are also identified on figure 2-123 for clear understanding.

2-112. Swing Lock Assembly

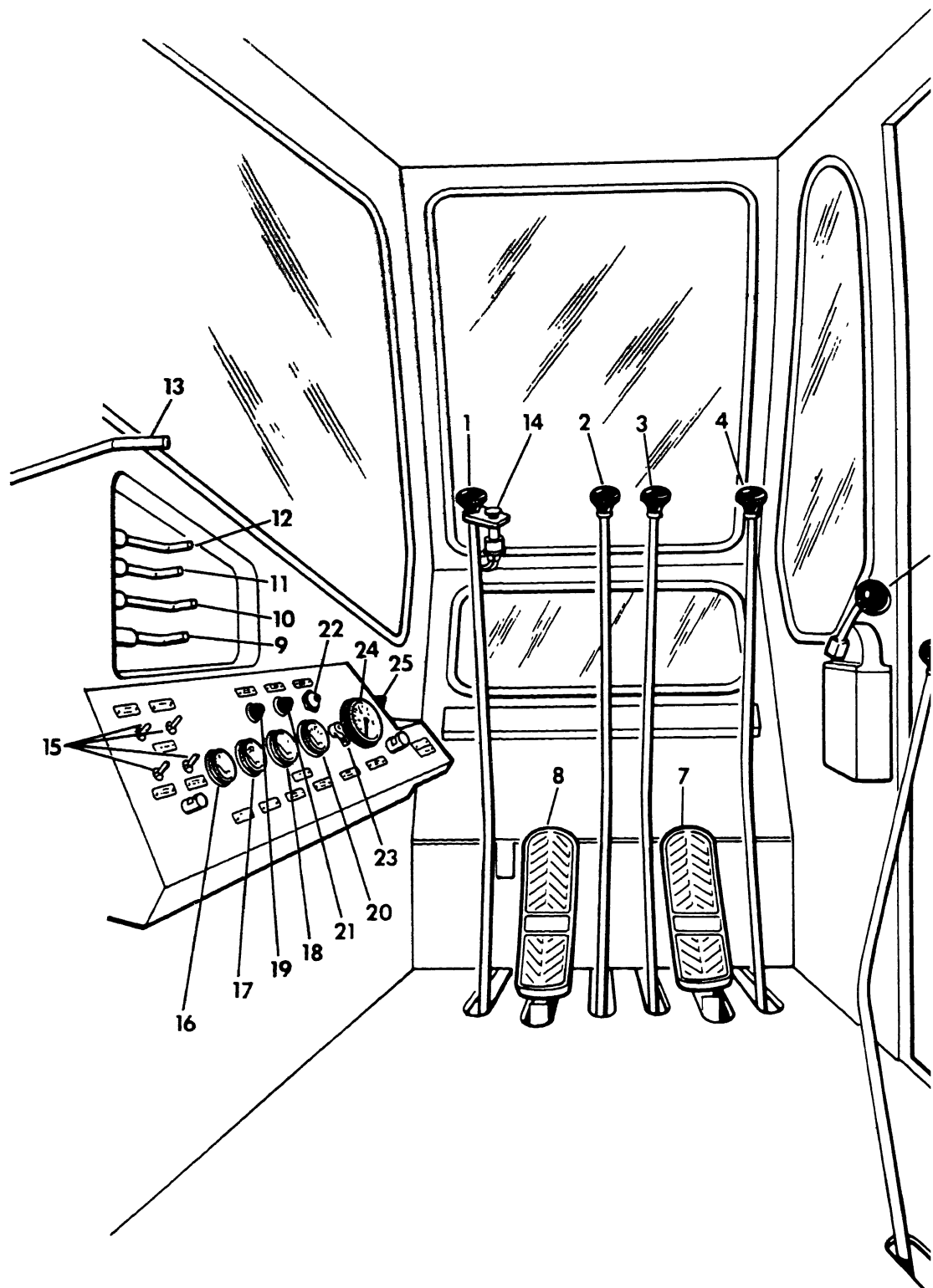
a. General. The swing lock assembly mechanically prevents the revolving frame from moving in relation to the carrier.

b. Adjustment. Remove deck plates as required to obtain access to the swing lock assembly. Refer to figure 2-68. Refer to figure 2-124 and adjust the swing lock assembly.

c. Removal. Refer to figure 2-124 and remove the cotter pins and pins identified to remove the swing lock assembly.

2-113. Pawls

a. General. Safety pawls are provided for the front drum, the rear drum, and the boom hoist drum. The purpose of the safety pawls is to prevent the load on the front or rear drum load



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Figure 2-106. Control identification. (Sheet 1 of 2)

- | | | |
|--------------------------------------|---|---------------------------------------|
| 1. Swing clutch lever | 10. Boom hoist drum pawl control | 19. Engine oil pressure warning light |
| 2. Front drum clutch lever | 11. Front drum pawl control | 20. Engine temperature gage |
| 3. Rear drum clutch lever | 12. Rear drum pawl control | 21. Engine temperature warning light |
| 4. Boom hoist clutch and brake lever | 13. Engine clutch lever | 22. Starter button (engine) |
| 5. Engine throttle control | 14. Horn button (or dipper trip switch) | 23. Ignition switch |
| 6. Swing brake lever | 15. Light switches | 24. Engine tachometer |
| 7. Rear drum brake pedal | 16. Engine fuel tank level gage | 25. Choke control |
| 8. Front drum brake pedal | 17. Voltmeter | 26. Rain shutter lever |
| 9. Swing brake lock control | 18. Engine oil pressure gage | |

Figure 2-106 (1) Continued

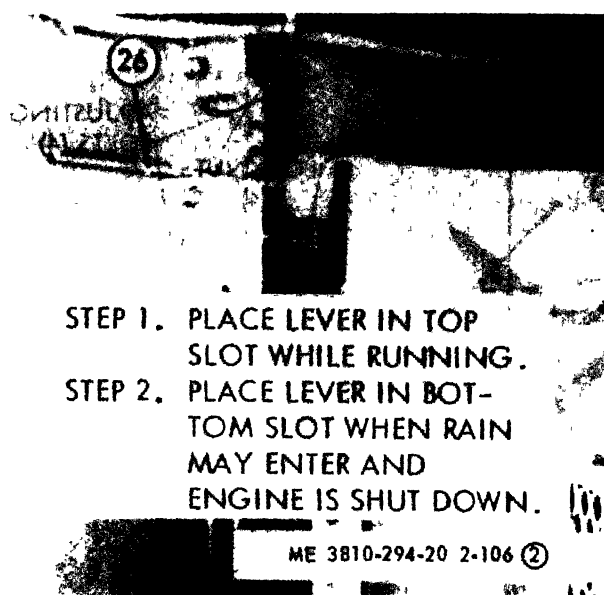


Figure 2-106. Control identification. (Sheet 2 of 2)

line from being accidentally dropped. All of these pawls should be kept engaged at all times that a load is being suspended aloft, and the boom hoist safety pawl should be engaged at all times, except when lowering the boom. The boom hoist planetary pawls, figure 2-125, are both manually and automatically operated. These pawls are operated by manual linkage attached to the engine clutch control. When the engine clutch is engaged, the pawls are engaged by automatically operated friction shoes, which allow the operator to drive the boom downward, rather than lower it by gravity. However, this machine is designed so that a load on either the front or rear drum can be lowered by gravity, with the engine clutch disengaged, by allowing the weight of the load to pull the machinery backward. If the friction shoes were not disengaged from their mating surface during this type of load lowering, the boom would be lifted as the load was lowered. Therefore, linkage has

been provided, as illustrated in figure 2-125, to pull the friction shoes out of contact with the boom hoist drum when the engine clutch is disengaged. This will allow a load on either load line to be lowered by gravity, without changing boom angle.

b. Adjustment. Refer to figure 2-126 and adjust safety pawls. Refer to figure 2-125, and see that the friction shoes are out of contact with their friction surface when the engine clutch is disengaged. Note that the length of the rod bolt can be changed. This adjustment is properly made at the time of manufacture and should not be changed. Do not disassemble or adjust the linkage shown in figure 2-125 unless parts are damaged and must be replaced. If this is the case, always see that the pawl friction shoes are disengaged from contact with their mating surface on the drum when the engine clutch is disengaged and that they make firm contact with the friction surface of the drum when the engine clutch is engaged.

2-114. Machinery Mechanism Controls

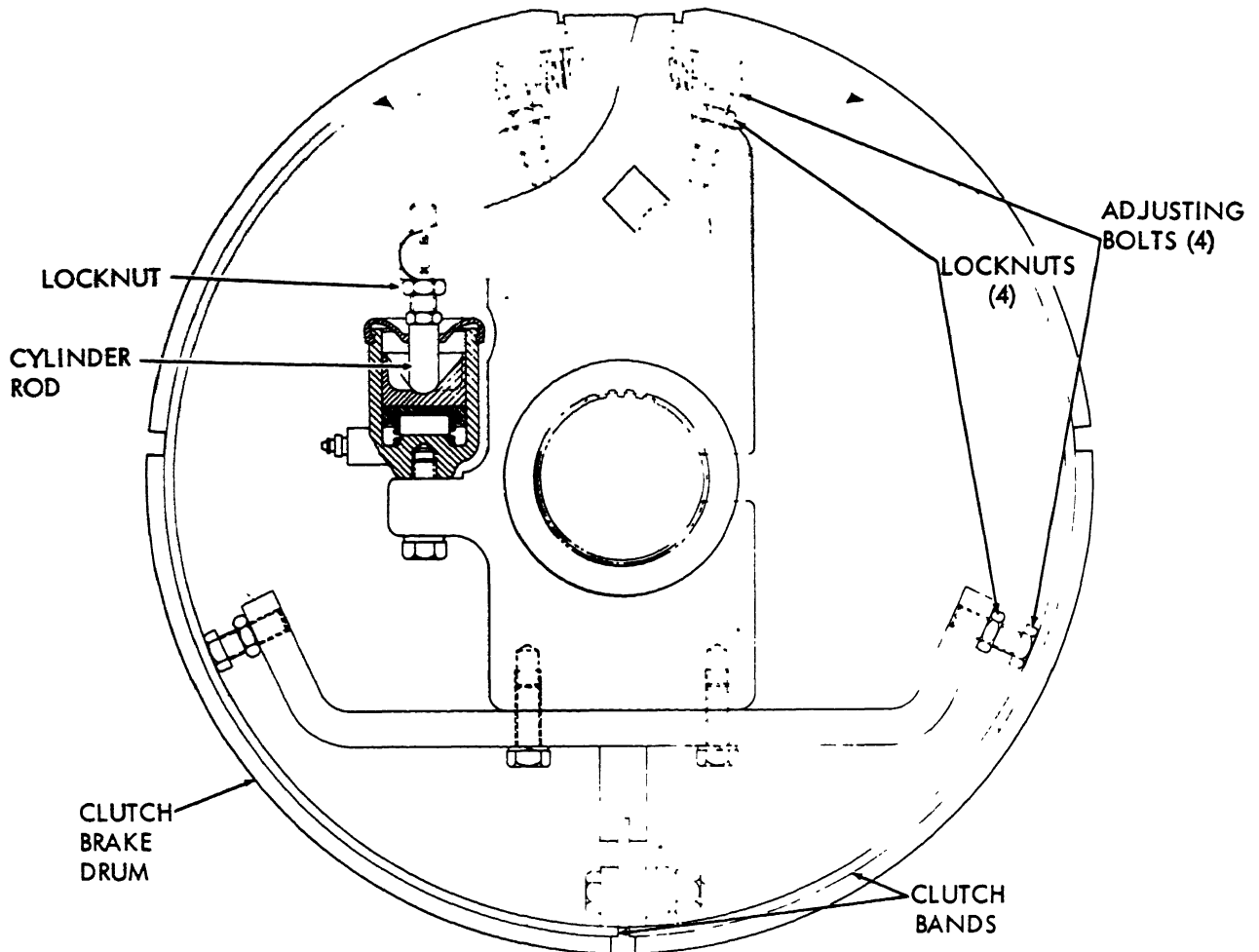
a. Control Levers and Pedals.

(1) *Service.* Lubrication and cleaning is required for control levers and pedals. Refer to LO 5-3810-294-12.

(2) *Adjust.* No adjustments should be required. However, stopscrews (adjusting screws) are furnished to limit the fore and aft movement of all control levers and pedals, as illustrated in figure 2-127. Adjust only the spring return tension on front and rear drum brake pedals and make this adjustment only after carefully checking front and rear drum brake adjustment. Refer to figure 2-128.

b. Toggle Lever Linkage. The front drum clutch lever, the rear drum clutch lever, the boom hoist clutch lever, and the swing brake lever are designed to "toggle in". Figure 2-127 illustrates the principle of operation of toggle linkage which must be understood to adjust such linkage. When the linkage moves from the neu-

- STEP 1. LOOSEN LOCKNUTS (4) WHICH SECURE ADJUSTING BOLTS (4).
- STEP 2. TURN ADJUSTING BOLTS OUT OF CONTACT WITH CLUTCH BANDS. CLUTCH BANDS MUST BE CENTERED IN CLUTCH DRUM. USE ADJUSTING BOLTS (4) TO CENTER CLUTCH BANDS. TIGHTEN LOCKNUTS.
- STEP 3. LOOSEN LOCKNUT ON CYLINDER ROD.
- STEP 4. TURN CYLINDER ROD OUT UNTIL A PULL OF 15 TO 20 POUNDS ON A SPRING SCALE IS NEEDED TO ENGAGE THE CLUTCH. TIGHTEN LOCKNUT.



NOTE: ONLY STEPS 3 AND 4 ABOVE ARE NECESSARY TO ADJUST FOR LINING WEAR. USE COMPLETE PROCEDURE ONLY WHEN CLUTCH HAS BEEN REMOVED AND REPLACED.

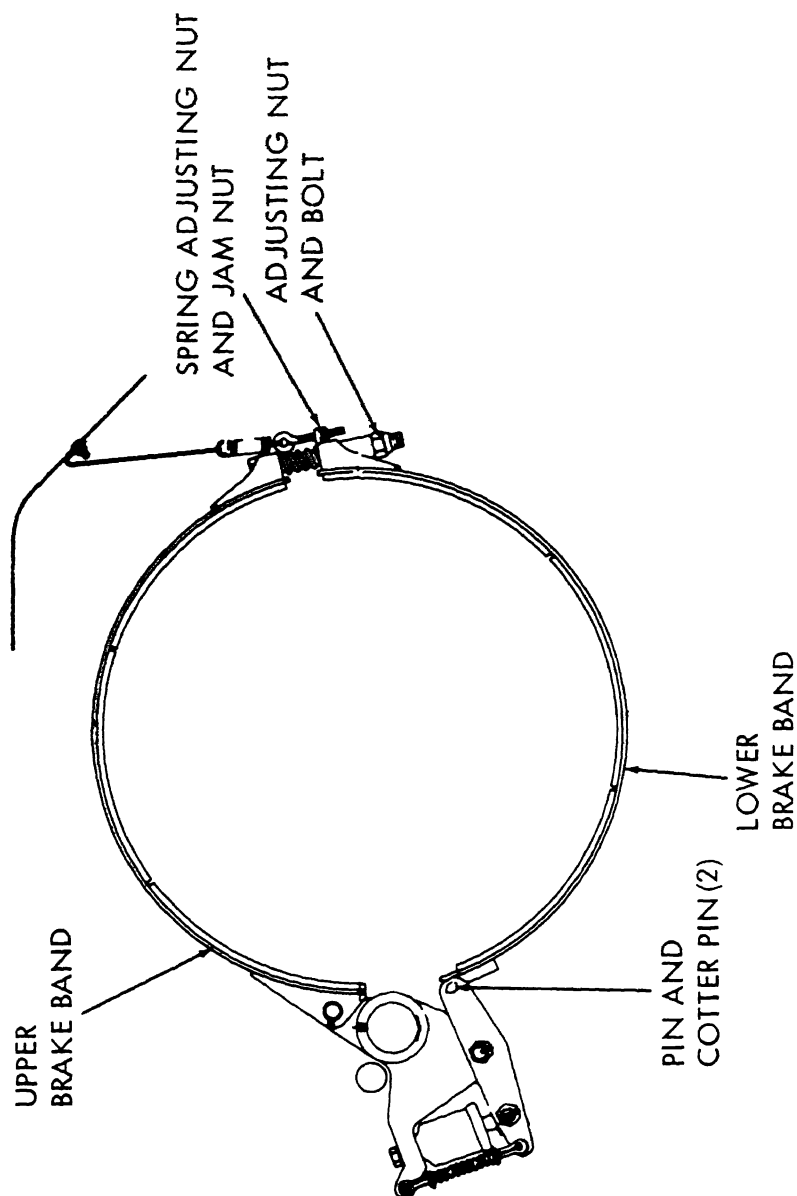
ME 3810-294-20/2-107

Figure 2-107. Adjusting front and rear drum clutch.

tral position shown in Sketch 1, point A approaches the straight line (or toggle point) as shown in Sketch 2. In the position shown in

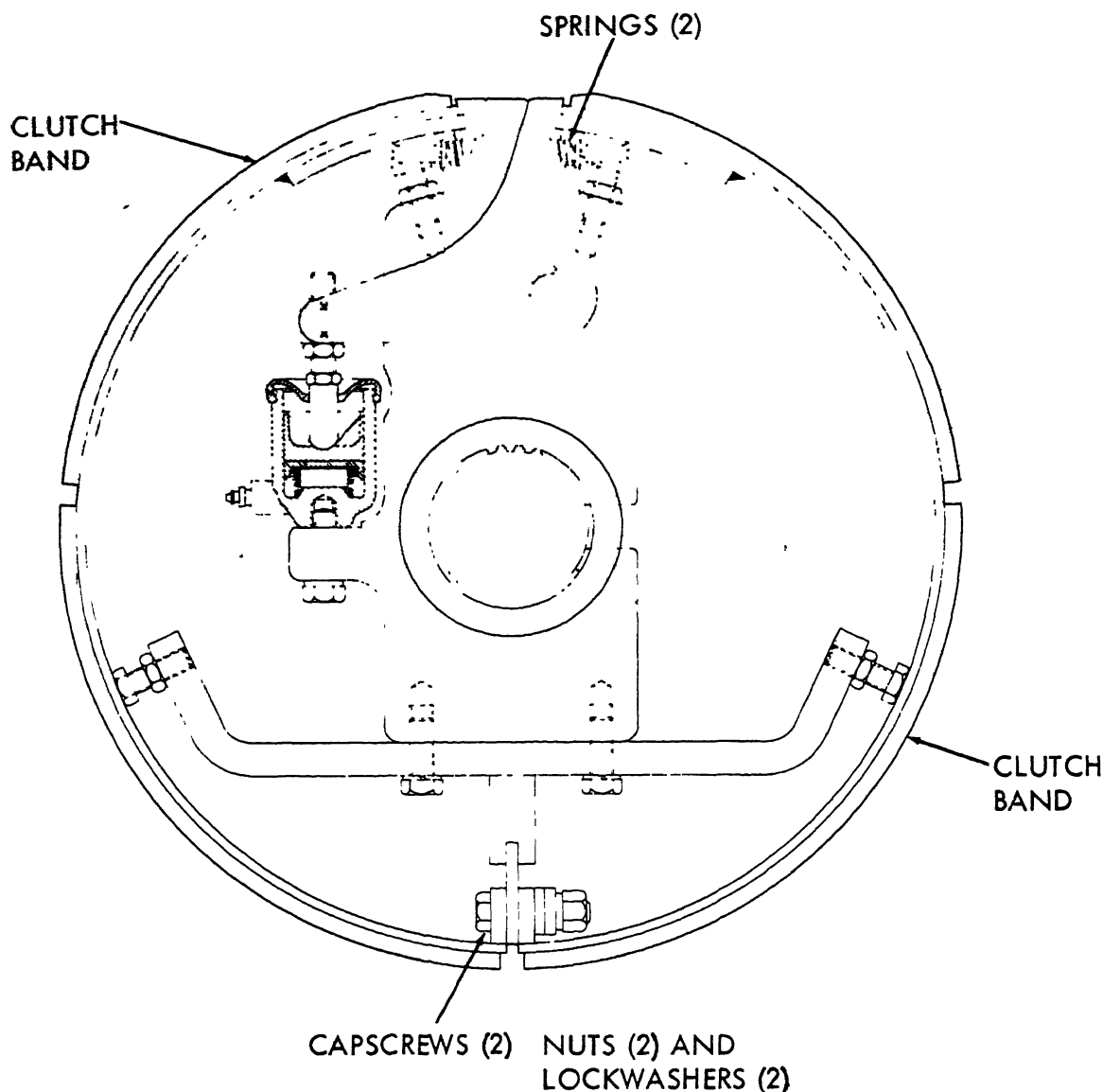
Sketch 2, the greatest possible amount of force is exerted outward against points B and C, with little effort on either the neutral position or the

- STEP 1. LOWER LOAD ON FRONT OR REAR DRUM LINE TO GROUND.
- STEP 2. REMOVE ADJUSTING NUT AND ADJUSTING BOLT.
- STEP 3. REMOVE COTTER PIN AND UPPER BRAKE BAND PIN. THESE PINS ARE REACHED FROM BEHIND REAR DRUM. REMOVE UPPER BRAKE BAND.
- STEP 4. REFER TO FIGURE 2-67 AND REMOVE LOWER BRAKE BAND COTTER PIN AND PIN THROUGH HAND HOLE.
- STEP 5. REMOVE SPRING ADJUSTING NUT AND JAM NUT. SLIDE LOWER BRAKE BAND AROUND DRUM AND REMOVE LOWER BRAKE BAND.
- STEP 6. REMOVE FRONT DRUM BRAKE BAND IN SAME MANNER.



ME 3810-294-20 '2-108

Figure 2-108. Rear drumshaft brake band, removal and replacement.



- STEP 1. LOWER LOAD TO GROUND.
- STEP 2. BE SURE IGNITION SWITCH IS IN OFF POSITION. REMOVE SPRINGS.
- STEP 3. USE ENGINE START PUSHBUTTON TO POSITION CLUTCH BAND WITH BAND SPLIT CAPSCREWS JUST ABOVE SIDEBAND. REMOVE CAPSCREWS AND SPLIT BAND.
- STEP 4. REMOVE UPPER CLUTCH BAND.
- STEP 5. TAP ENGINE START PUSHBUTTON TO POSITION OTHER CLUTCH BAND ON TOP. REMOVE OPPOSITE CLUTCH BAND.

ME 3810-294-20/2-109

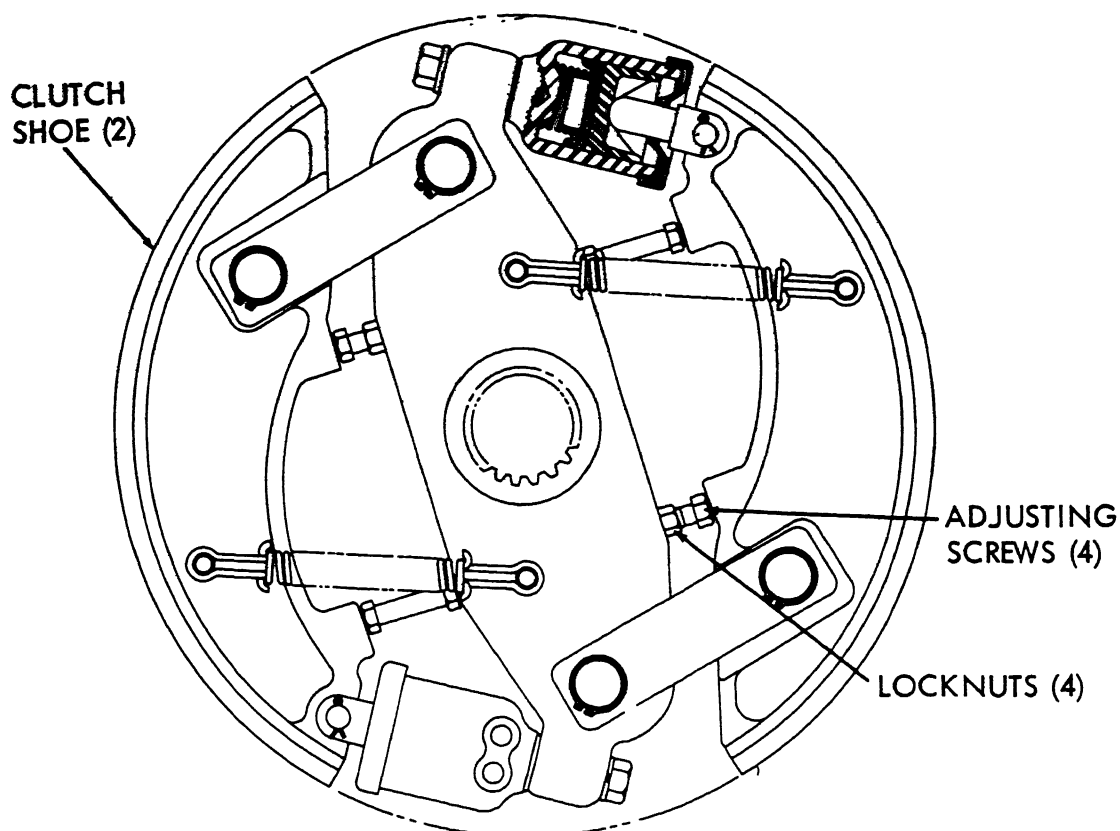
Figure 2-109. Rear drumshaft clutch band, removal and replacement.

"toggle in" position with a minimum amount of effort. All the operator has to do is provide the amount of force needed to push the lever past the toggle point in either direction, and the force

exerted against points B and C will force the lever as far in that direction as it can go. In Sketch 3, the operator has pushed the control lever past the toggle point. The lever will stay

- STEP 1. LOOSEN LOCKNUTS ON ADJUSTING SCREWS.
 STEP 2. REFER TO FIGURE 2-32 AND ENGAGE THE SWING CLUTCH LEVER.
 STEP 3. BACK OFF ON ALL ADJUSTING SCREWS UNTIL THERE IS A 0.020 INCH GAP BETWEEN HEADS OF ADJUSTING SCREWS AND CLUTCH SHOES. TIGHTEN LOCKNUTS AND RECHECK GAP.

NOTE: MAKE ABOVE ADJUSTMENT FOR FIRST ONE CLUTCH SHOE AND THEN THE OTHER. BE SURE CLUTCH SHOES DO NOT DRAG.

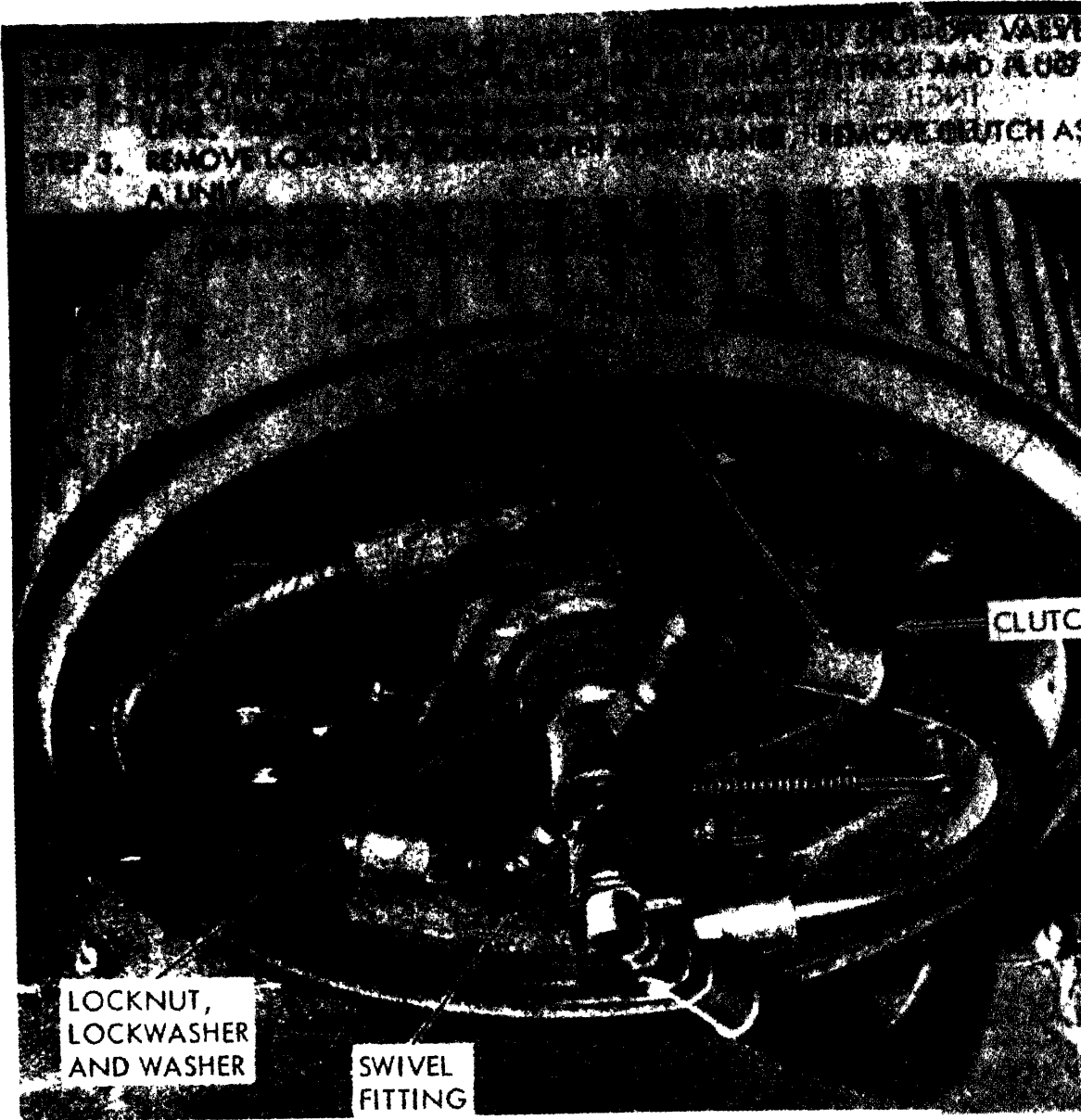


ME 3810-294-20/2-110

Figure 2-110. Adjusting reversing shaft clutch or horizontal swing shaft clutch.

in the forward position until the operator pulls it back, past the toggle point, to the neutral (center) position. It is important that only the four levers which are designed for toggle linkage action,

and which are listed in this paragraph, be allowed to "toggle in". Refer to figure 2-127 and adjust toggle linkage.



ME 3810-294

Figure 2-111. Reversing shaft or horizontal swing shaft clutch, removal or replacement.



- STEP 1. LOWER ATTACHMENT TO GROUND.
- STEP 2. PLACE SUITABLE ROD IN HOLE IN PUSHROD.
- STEP 3. TURN PUSHROD TO COMPRESS SPRING. TURN UNTIL SPRING IS REDUCED IN LENGTH TO 4-5/8" AS SHOWN.

ME 3810-294-20 2-112

Figure 2-112. Boom hoist brake adjustment.

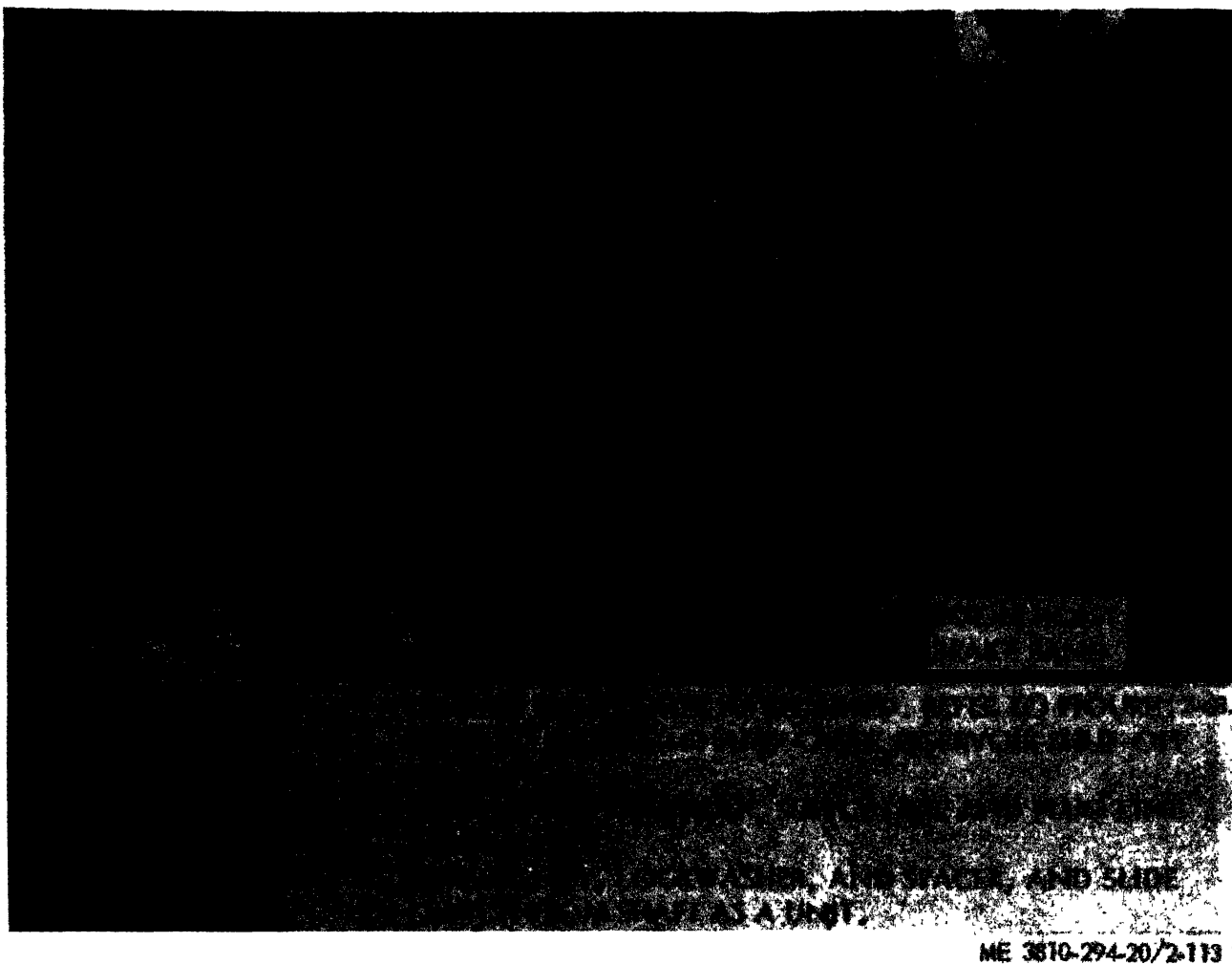


Figure 2-113. Boom hoist clutch removal and replacement.



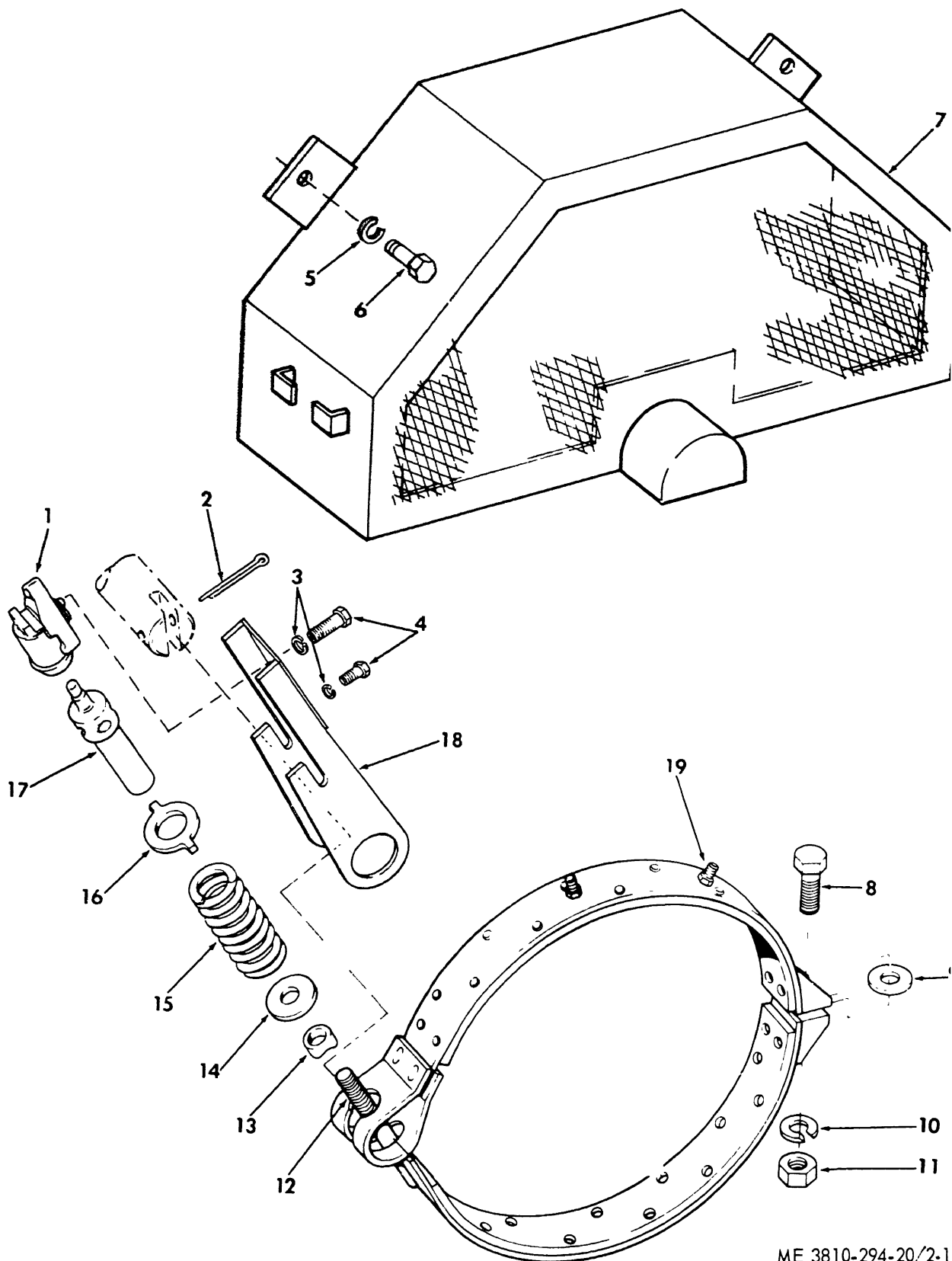


Figure 2-114. Boom hoist brake hand, removal and replacement.

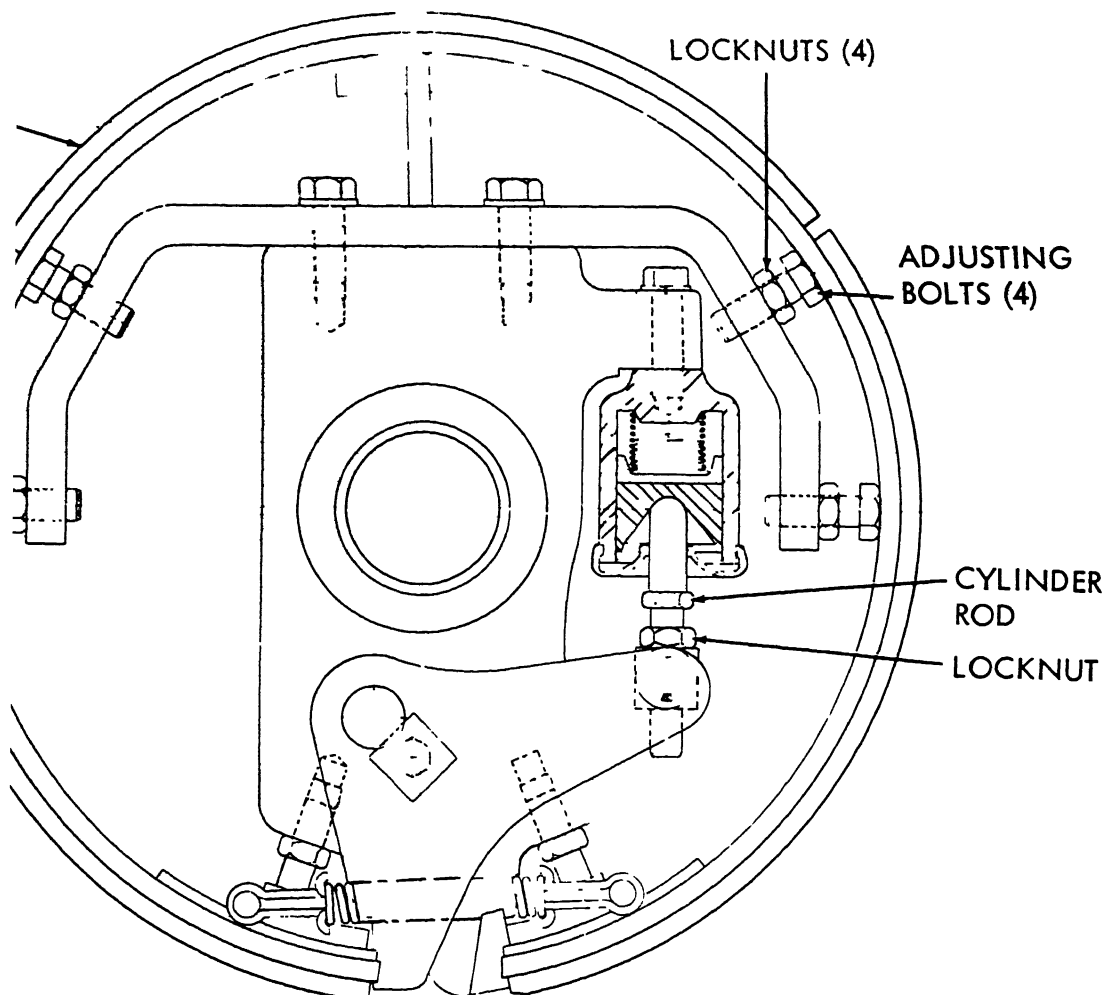
ME 3810-294-20/2-1

1. Brake cylinder
2. Pin, cotter
3. Lockwasher
4. Capscrew
5. Lockwasher
6. Screw
7. Guard

8. Capscrew
9. Washer, flat
10. Lockwasher
11. Nut
12. Rod, threaded
13. Spacer
14. Washer, flat

15. Spring
16. Washer, brake
17. Pushrod
18. Bracket
19. Brake band assembly

Figure 2-114 — Continued



LOOSEN LOCKNUTS WHICH SECURE ADJUSTING BOLTS.
 TURN ADJUSTING BOLTS OUT OF CONTACT WITH CLUTCH
 BAND. CLUTCH BAND MUST BE CENTERED IN CLUTCH DRUMS.
 USE ADJUSTING BOLTS TO CENTER CLUTCH BAND.
 TIGHTEN LOCKNUTS.

LOOSEN LOCKNUT ON CYLINDER ROD.
 TURN CYLINDER ROD OUT UNTIL A PULL OF 15 TO 20 POUNDS
 ON A SPRING SCALE IS NEEDED TO ENGAGE THE CLUTCH.
 TIGHTEN LOCKNUT ON CYLINDER ROD.

ONLY STEPS 3 AND 4 ABOVE ARE NECESSARY TO ADJUST FOR
 LINING WEAR. USE COMPLETE PROCEDURE ONLY WHEN
 CLUTCH HAS BEEN REMOVED AND REPLACED.

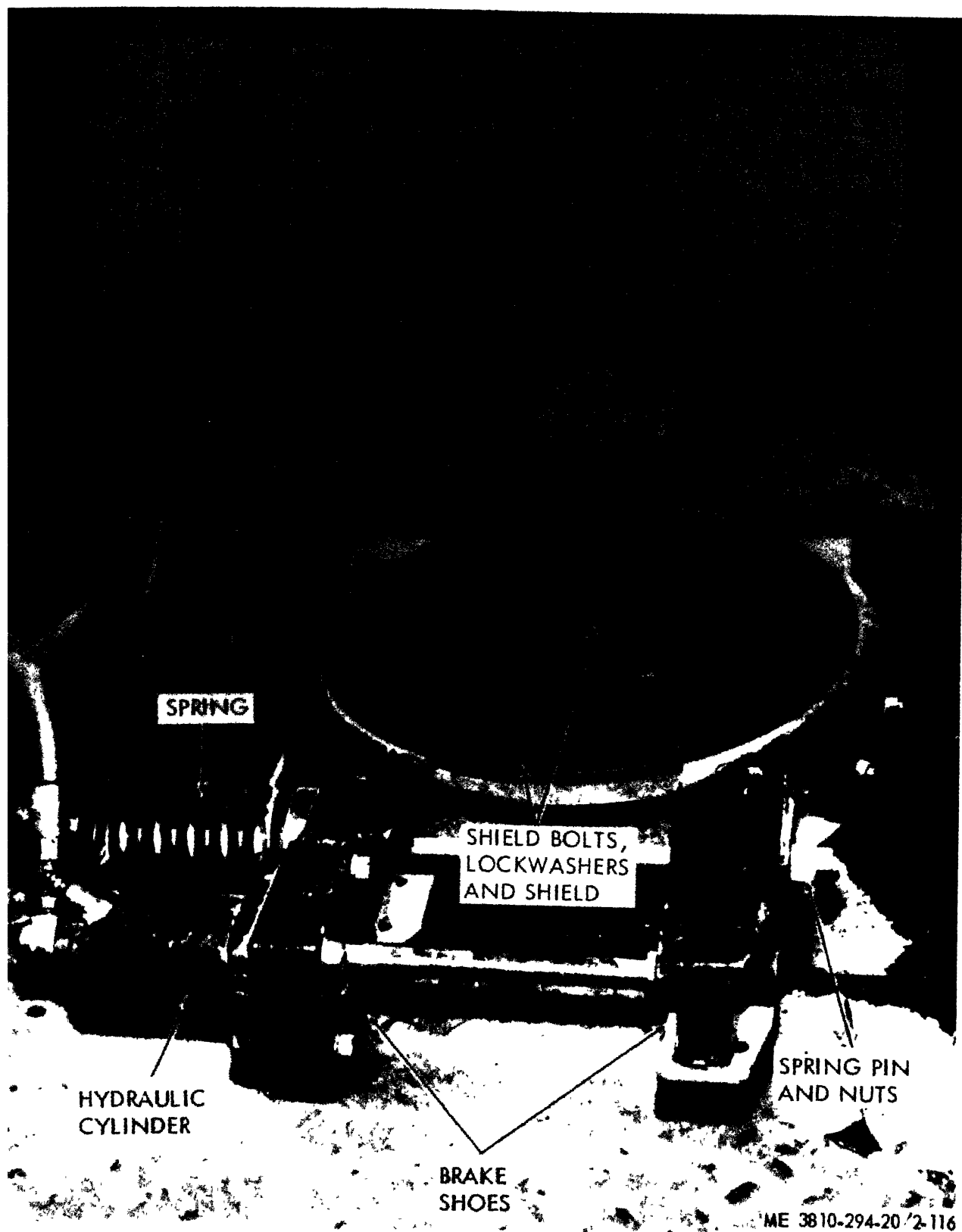


Figure 2-116. Swing brake shoes removal and replacement.

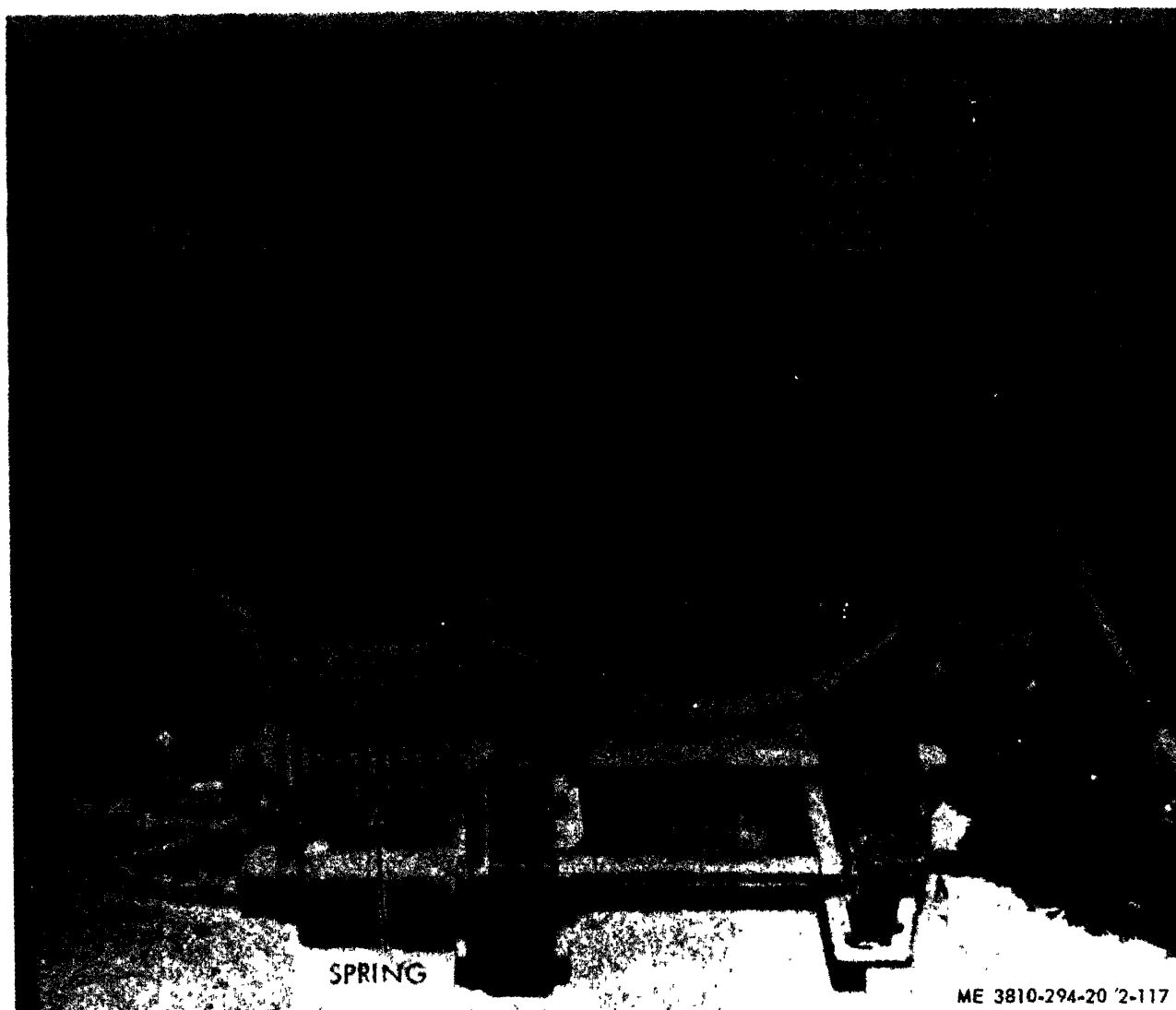
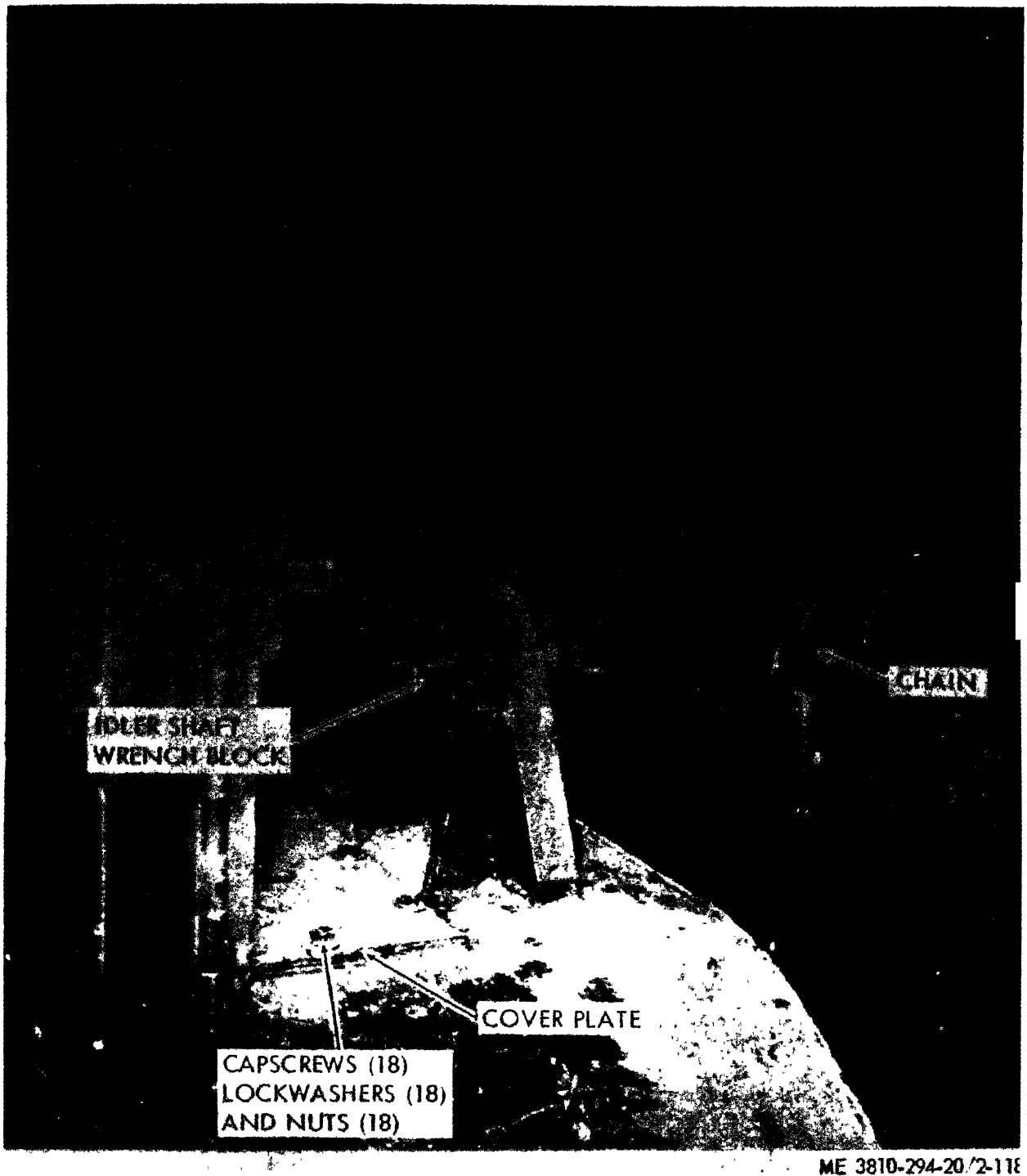
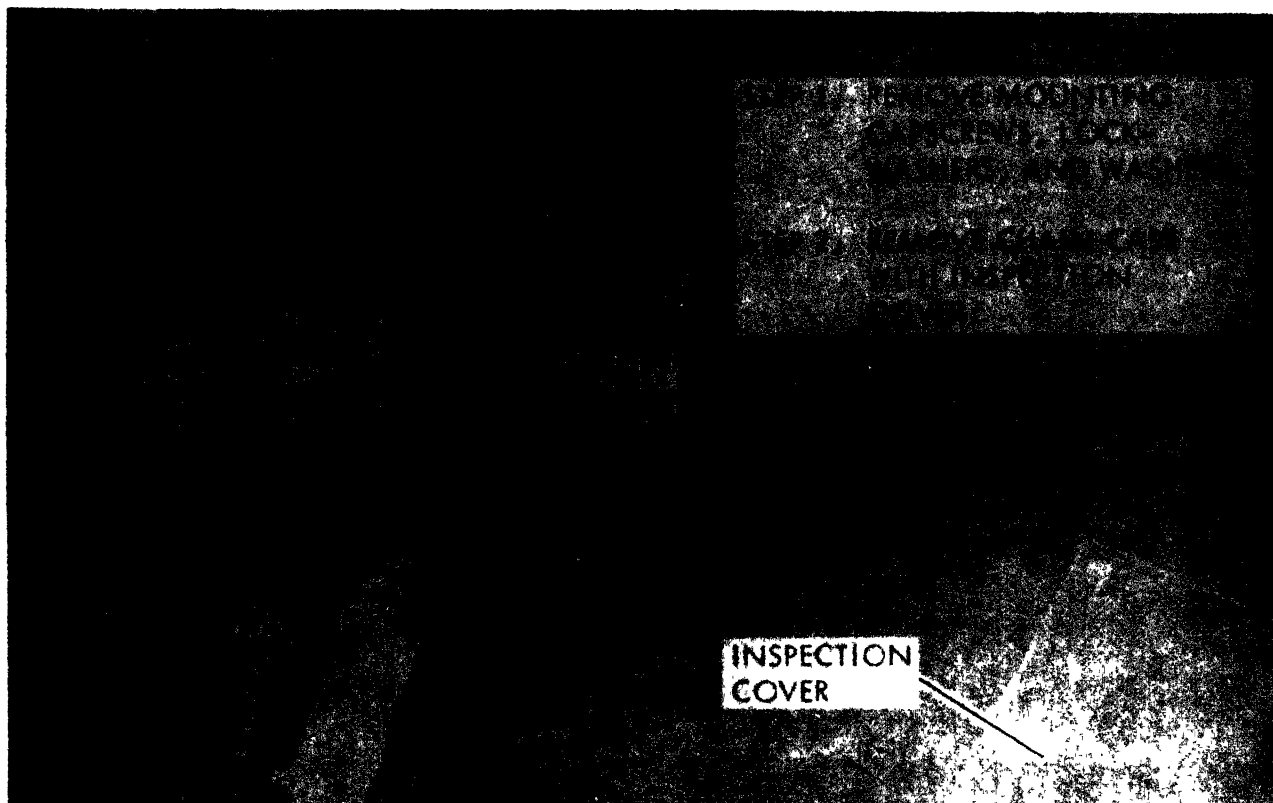


Figure 2-117. Swing brake adjustment.



ME 3810-294-20/2-118

Figure 2-118. Reversing shaft chain removal and replacement.



ME 3810-294-20 2-119

Figure 2-119. Rear drum chain case removal and replacement.

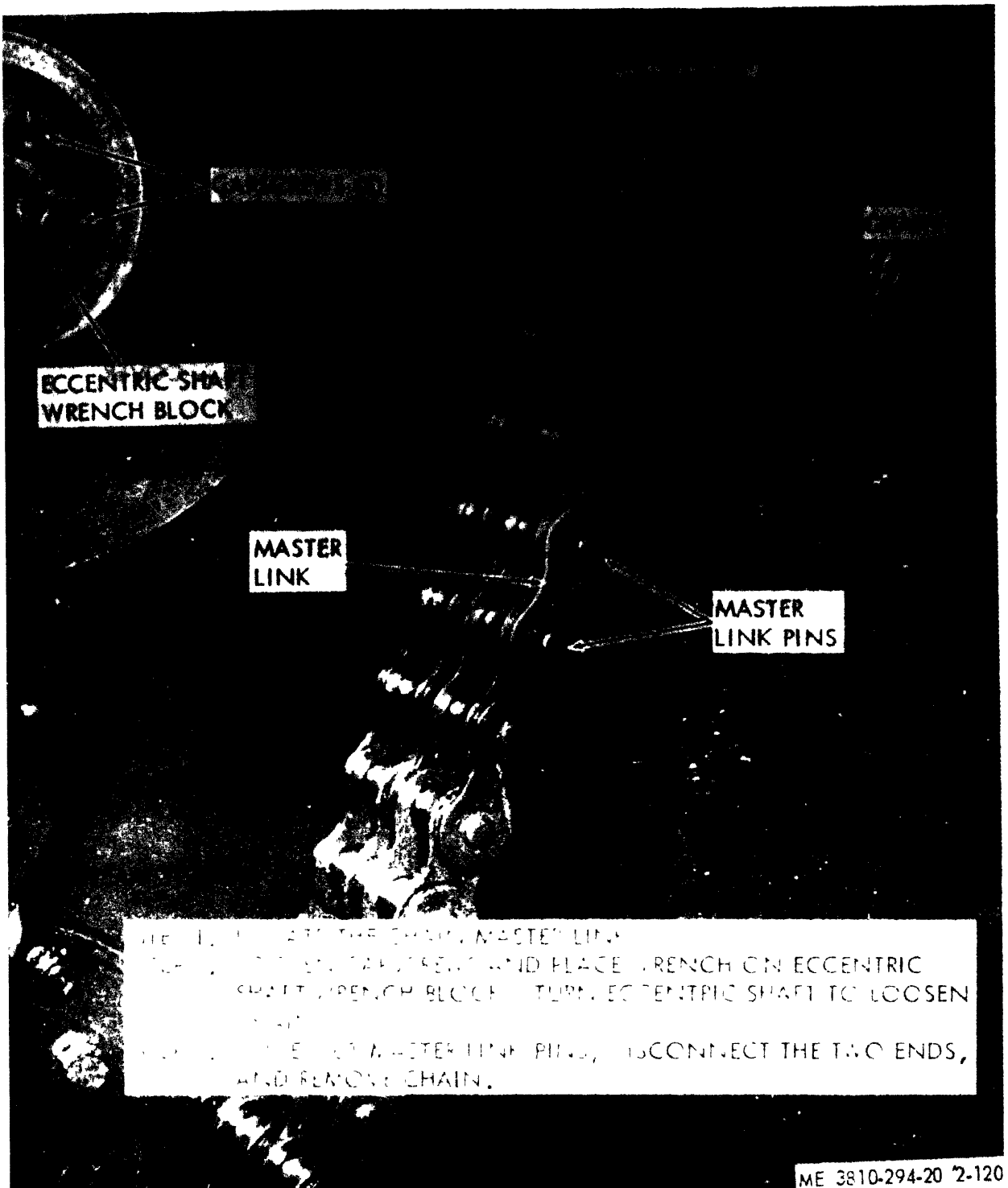
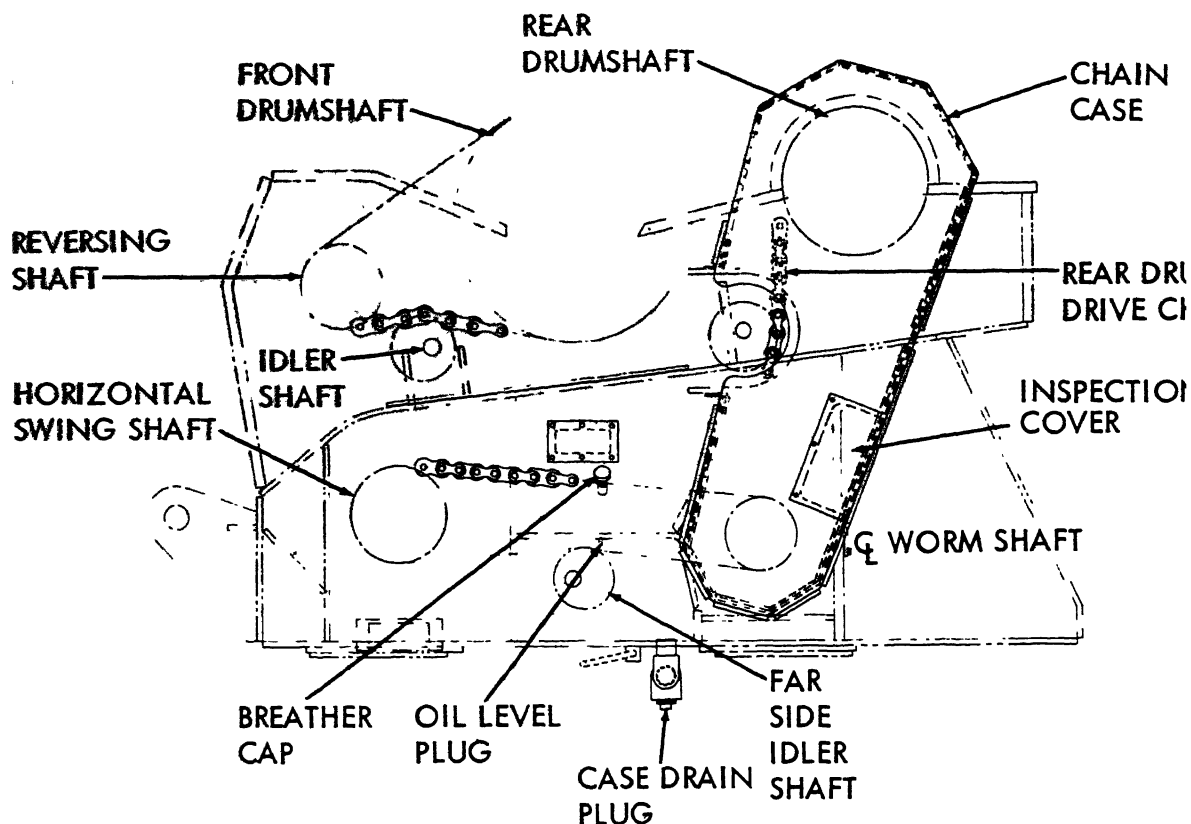


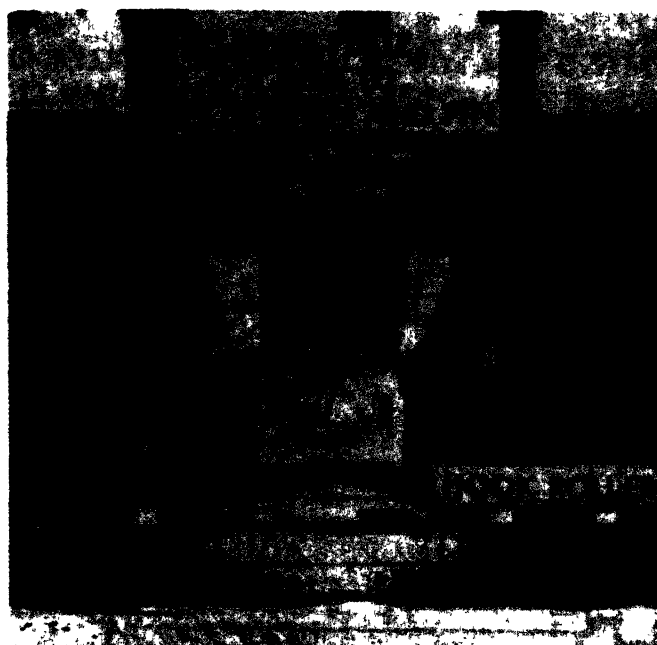
Figure 2-120. Rear drum drive chain removal and replacement.



- STEP 1. TURN REVOLVING FRAME SO MAIN GEARCASE DRAIN LINES UP WITH HOLE IN FRAME.
- STEP 2. REMOVE CASE DRAIN PLUG. HAVE AN ADEQUATE CONTAINER FOR CASE OIL.
- STEP 3. REMOVE INSPECTION COVER.
- STEP 4. REFER TO FIGURE 2-120 FOR VIEW OF MASTER LINK. LOCATE MASTER LINK AND DRIVE OUT LINK PINS. REMOVE CHAINS.

ME 3810-294-20/

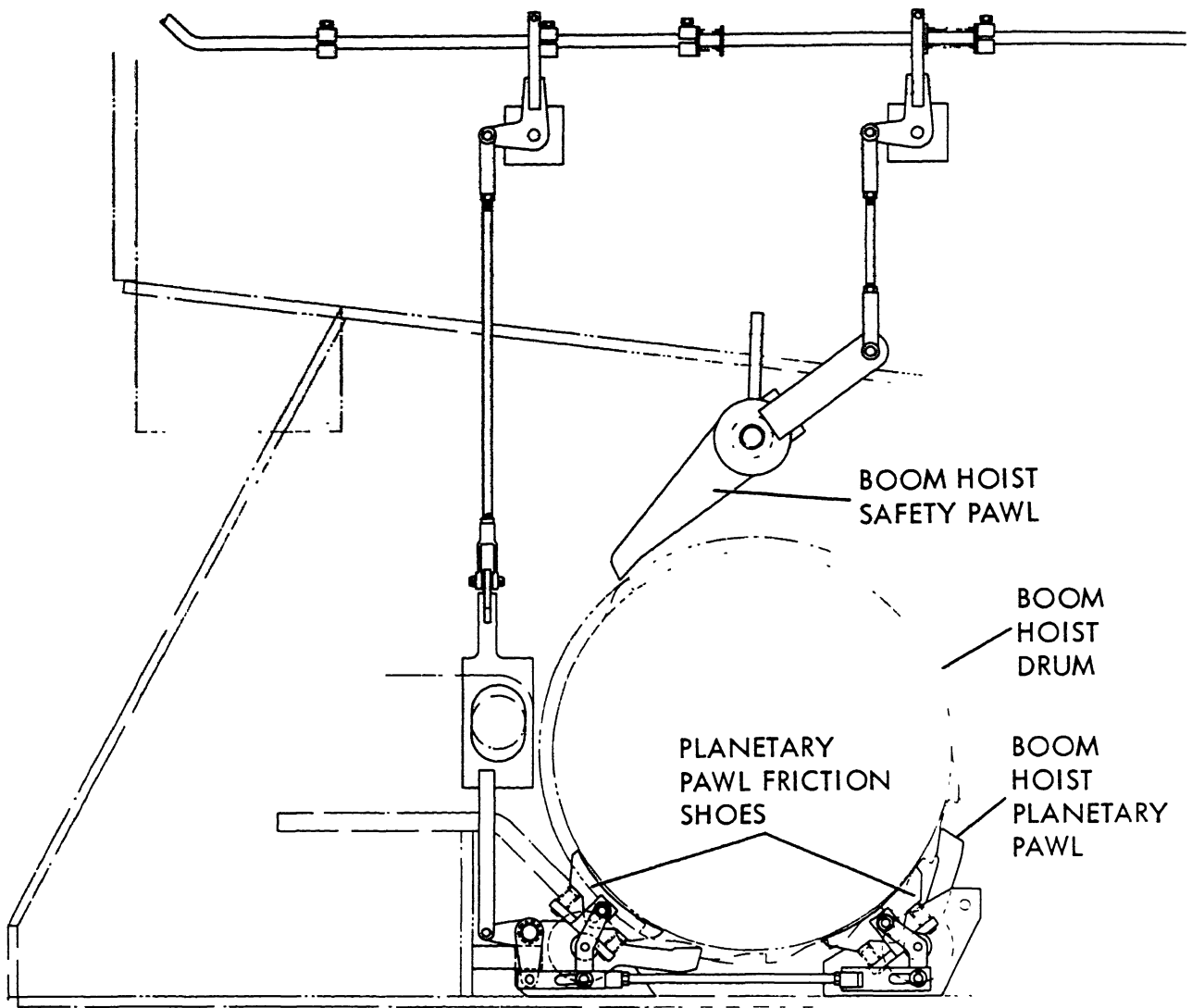
Figure 2-121. Horizontal swing shaft chains removal and replacement.



- STEP 1. PLACE SOLID BLOCKING
BETWEEN REVOLVING
FRAME AND CARRIER AT
OPPOSITE END OF REVOLV-
ING FRAME.
- STEP 2. REMOVE RETAINER PLATE
CAPSCREWS, RETAINER
PLATE, COTTER PIN, AND
PIN.
- STEP 3. REMOVE HOOK ROLLER.

ME 3810-294-20 2-122

Figure 2-122. Hook rollers, removal and replacement.



ME 3810-294-20/2-125

Figure 2-125. Boom hoist planetary pawls.

- STEP 1. LOWER BOOM AND LOAD ON FRONT AND REAR DRUM TO GROUND.
- STEP 2. PLACE PAWL LEVER IN ENGAGED POSITION. SEE THAT PAWL ENGAGES RATCHET FULLY.
- STEP 3. PLACE PAWL LEVER IN DISENGAGED POSITION AND SEE THAT PAWL CLEARS RATCHET BY ABOUT 1/2 INCH.
- STEP 4. IF PAWL DOES NOT ENGAGE FULLY IN RATCHET, OR DOES NOT FULLY DISENGAGE FROM RATCHET, LOOSEN JAM NUTS AND ADJUST ADJUSTING NUTS UNTIL SPRING LENGTH IS CORRECT AND PAWL DOES ENGAGE AND DISENGAGE PROPERLY.
- STEP 5. THE SAME PROCEDURE APPLIES TO FRONT AND REAR DRUM PAWL CONTROLS.

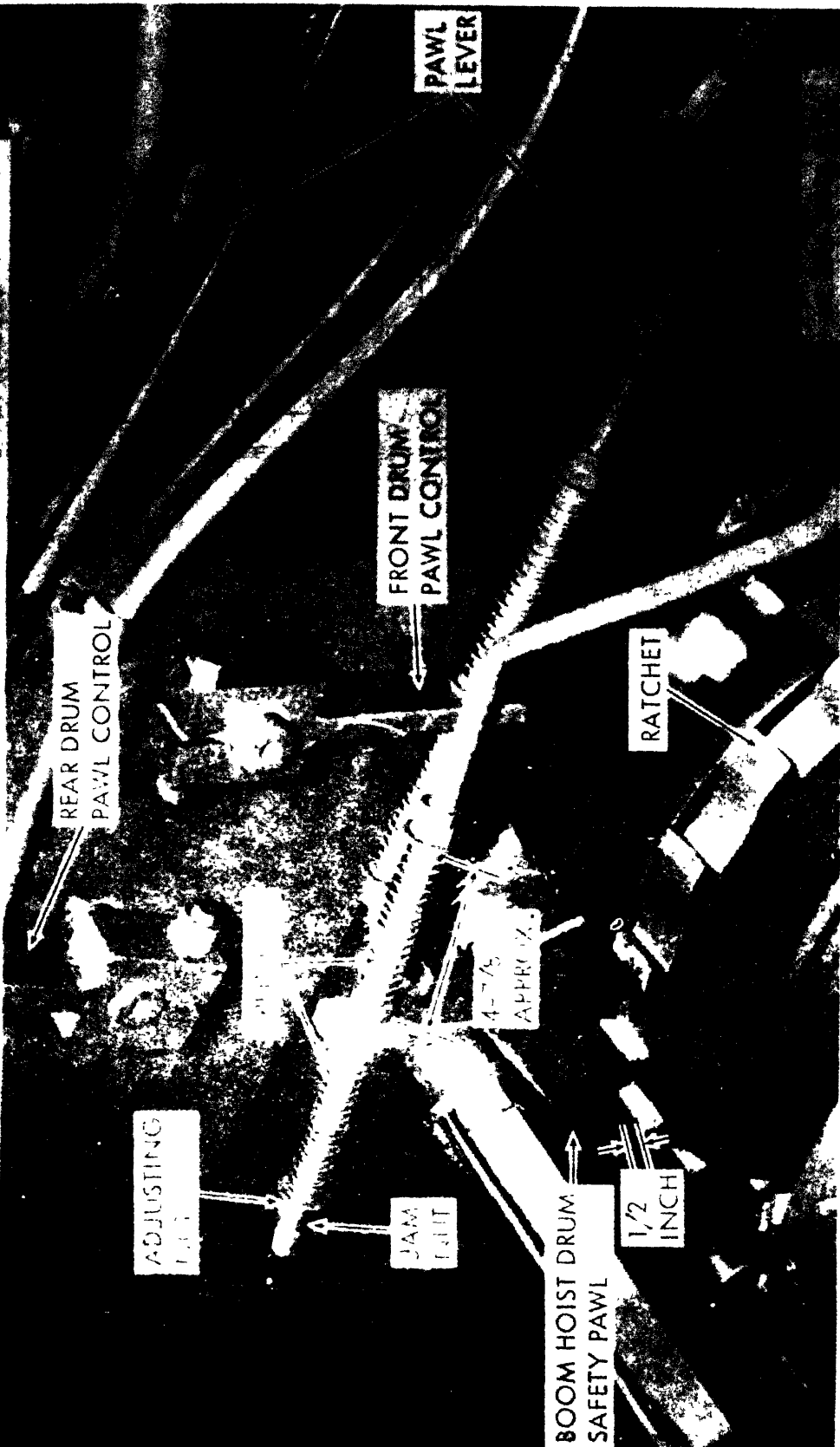
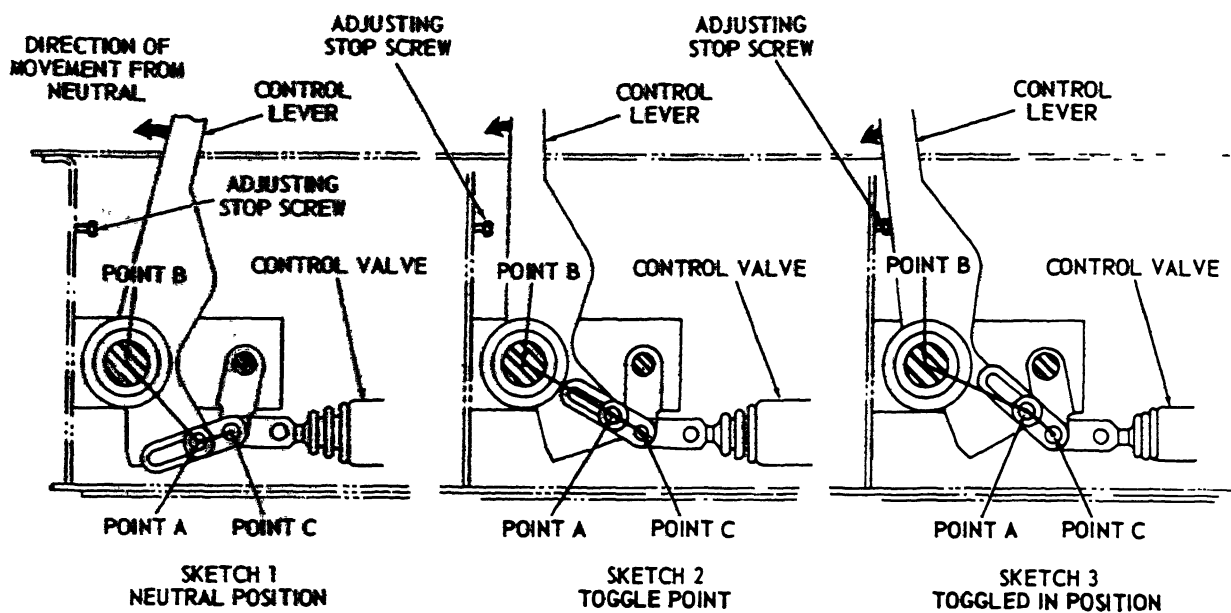


Figure 2-126. Boom hoist drum, rear drum, and front drum safety pawl adjustment.



ME 3810-294-20/2-127

Figure 2-127. Toggle linkage adjustment.



NOTE: CHECK ADJUSTMENT OF FRONT AND REAR DRUM BRAKES BEFORE ADJUSTING PEDAL SPRING TENSION.

ME 3810-294-20 2-128

Figure 2-128. Adjusting front and rear drum brake pedal return spring tension.

Section XXVIII. MAINTENANCE OF COUNTERWEIGHT

2-115. General

The counterweight is mounted on the revolving frame assembly. It will normally be removed only if the mounting bolts are damaged.

2-116. Counterweight Removal and Installation

CAUTION

Proceed slowly and carefully when removing or installing the counterweight, since severe damage can be caused by improper handling.

a. Install two eyebolts and a suitable lifting sling in the tapped holes provided in the top of the counterweight, and lift the counterweight into position on the two locating pins on the deck of the carrier. The locations of the pins are shown in figure 2-129. Use the crane boom and main hoist line to lift the counterweight.

b. Remove the eyebolts and stow them in the tool box.

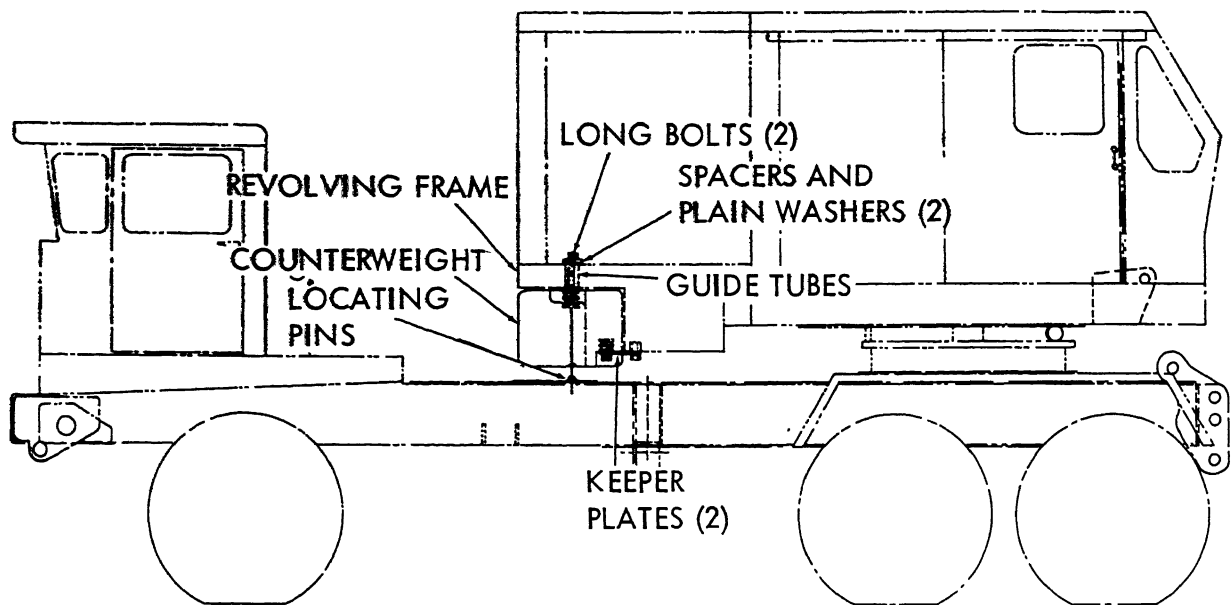
c. Swing the revolving frame so that the rear of the revolving frame is positioned over the

the revolving frame are directly above the two tapped holes in the counterweight.

d. Insert the two long bolts through the guide tubes in the revolving frame, with spacers and plain washers located as shown in figure 2-129,

usually by tightening the bolts evenly.

e. Bolt the keeper plates into position as shown in figure 2-129 and make certain that all bolts have been tightened firmly.



ME 3810-294-20/2-129

Figure 2-129. Counterweight, removal and replacement.

Section XXIX. MAINTENANCE OF MISCELLANEOUS ITEMS

2-117. Data Plate Inspection and Replacement

a. *General.* Data plates containing identification, instructions, warnings, cautions, and other pertinent data are illustrated in TM 5-3810-294-10. The plates are mounted on the machine with screws, lockwashers, and nuts.

b. *Inspection and Replacement.* Inspect all data plates for readability, loose or missing mounting hardware, and other physical damage. Replace missing hardware and defective plates.

2-118. Cable Inspection and Replacement

a. *General.* Cables used for boom or load handling should be inspected daily to determine if they are suitable for further use. Replace a cable if any of the following conditions is detected:

(1) If the core shows through more than one pair of strands.

(2) If kinking damage is severe.

(3) If there is evidence of improper lubrication combined with other defects.

(4) If the cable has come in contact with an electrical circuit or has been overheated in some other manner.

(5) If there is a serious reduction in rope size.

(6) If there is evidence of "bird-caging" This condition of suddenly increased size is usually caused by the sudden release of a heavy load while the cable is twisted.

(7) Broken wires at the dead end of a cable are cause for cutting off a section. Cut at least three feet beyond the broken wires, then refasten or resocket the cable.

(8) If there are numerous broken wires, or as many as three adjacent broken wires within a distance along the cable in which one wire strand makes a complete turn around the cable.

(9) If corrosion or rust damage is apparent.

cable replacement. Refer to *c* below when it is necessary to shorten a cable.

c. Cutting Cable to Proper Length. When cutting cable, seizings must be placed on each side of the point where the cable will be cut. On

cut is enough. On non-preformed cable less than 7/8-inch diameter, two seizings are to be used. On non-preformed cable over 7/8-inch diameter, three seizings are recommended. Use abrasive cutting tools, wire cutters, or blade action tools or flame cutters.



PART TWO CRANE CARRIER

CHAPTER 3 INTRODUCTION

Section I. GENERAL

3-1. Scope

a. This part of the manual gives organizational level maintenance instructions for proper care of the carrier portion of the machine. Maintenance personnel shall be thoroughly familiar with both crane and carrier maintenance procedures as described in this manual before attempting service or maintenance of this machine.

b. Refer to paragraph 1-1 for detailed instructions for the use of this manual.

3-2. Maintenance Forms and Records

Maintenance forms and records that you are required to use are explained in TM 38-750.

3-3. Destruction of Army Material to Prevent Enemy Use

Refer to TM 750-244-3 for procedures for destruction of equipment to prevent enemy use.

3-4. Administrative Storage

Refer to TM 740-90-1 for information concerning administrative storage.

3-5. Reporting of Errors

Refer to paragraph 1-5 for instructions.

Section II. DESCRIPTION AND DATA

3-6. Description

A general description of the crane and information pertaining to the identification plates are contained in TM 5-3810-294-10. A more detailed description of specific components and assemblies is contained in the applicable sections of this manual. Detailed descriptions of the components of the carrier are provided in the applicable maintenance paragraphs of this manual.

3-7. Identification and Tabulated Data

a. *Identification.* All identification plates for the carrier are located, identified, and illustrated in TM 5-3810-294-10.

b. *Tabulated Data.*

(1) *Carrier.*

Manufacturer Harnischfeger
Model M320T2

(2) *Carrier engine* (see fig. 3-1).

Manufacturer International Harvester
Company
Model UV-549
Number of cylinders 8

Horsepower 201 net hp at 2800 rpm
full load
Displacement 549 cubic inches
Gage compression 145 psi at 200 rpm
Firing order 1-3-7-3-6-5-4-2
Ignition timing Top dead center
Governed speed (high idle) .. 2800 \pm 10 rpm
Low idle speed 450 \pm 50 rpm
Maximum oil pressure
(above 1500 rpm) 50-to 55-pounds per square
inch
Minimum oil pressure
(idling) 15-to 20-pounds per square
inch
Intake and exhaust valve
tappet clearance Engine equipped with
hydraulic valve lifters.
Tappet clearance adjust-
ments not required.
Electrical system 24 volts, negative ground
Spark plug gap 0.028-to 0.033-inch
Distributor point gap 0.017 inch

(3) *Fuel, water, oil, and grease capacities, carrier.*

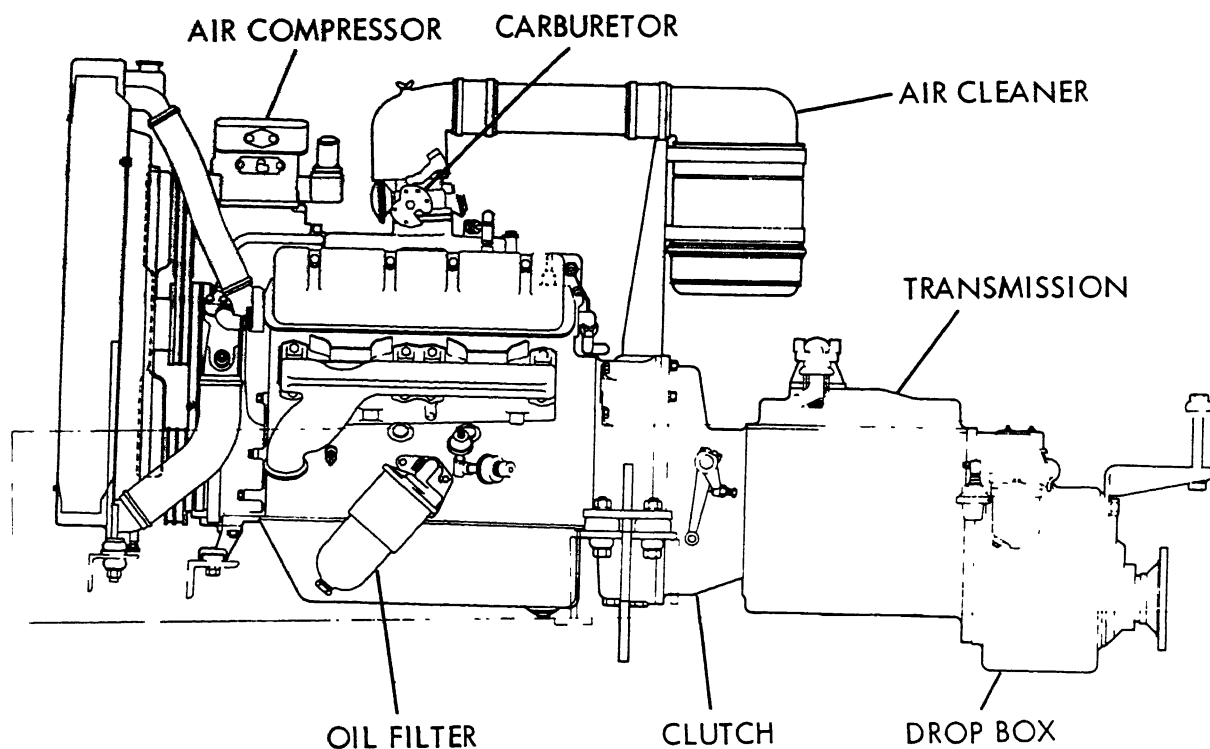
Engine fuel tank 75 gallons
Cooling system 40 quarts
Crankcase 12 quarts including filter

Transmission	8 quarts
Drop box	4 quarts
Transfer case	4 1/4 quarts
Front axle	11 quarts
Front rear axle	11 1/2 quarts
Rear rear axle	11 quarts
Steering gear and tank	3 1/4 quarts

(4) *Carrier hydraulic steering system (fig. 3-2).*

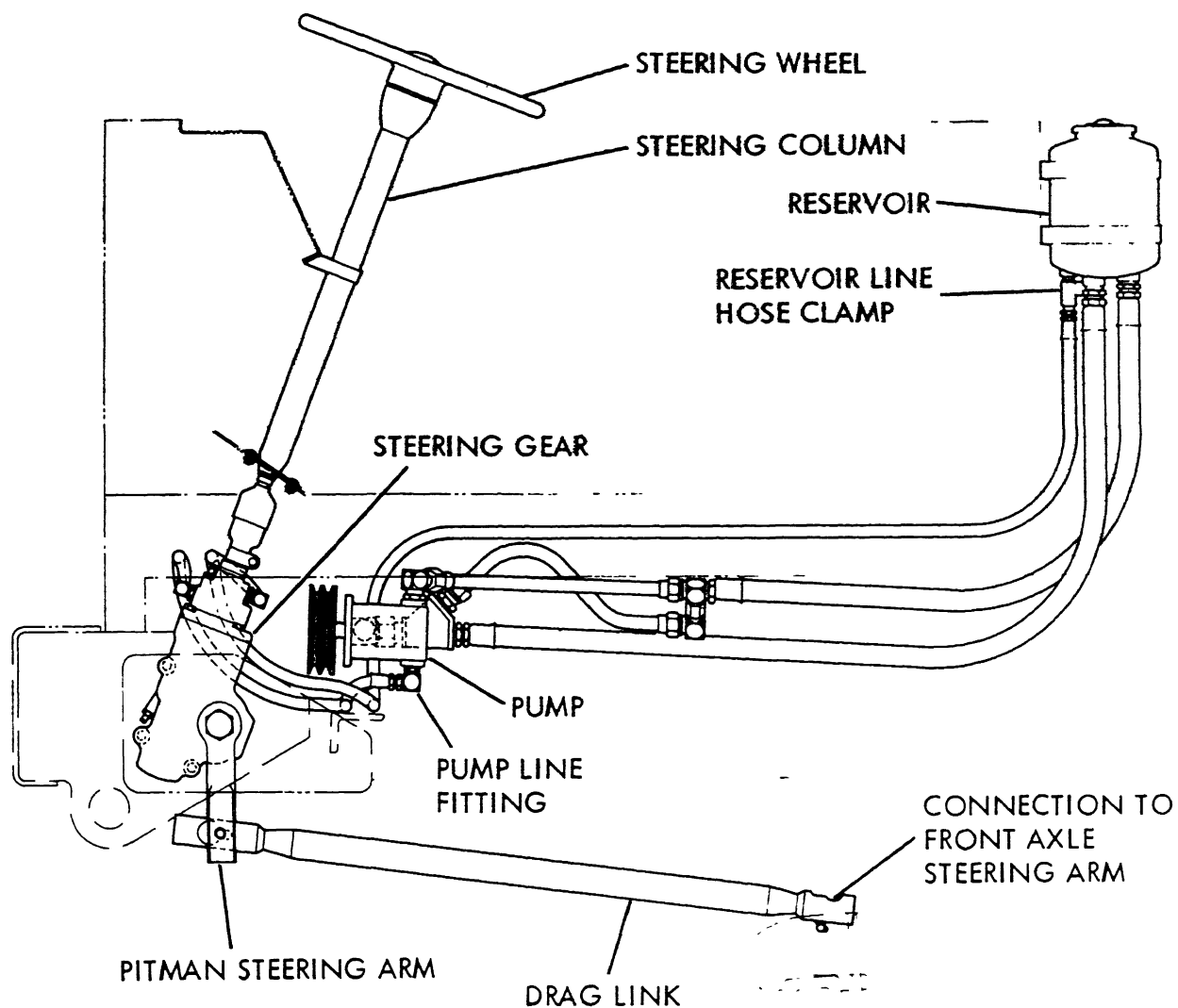
(5) *Carrier air brake system (fig. 3-3).*

(6) *Carrier wiring diagram (fig. 3-4(1) and 3-4(2)).*



ME 3810-294-20 3-1

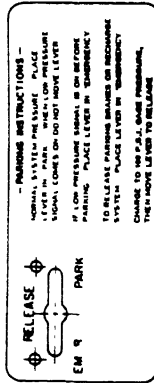
Figure 3-1. Carrier engine.



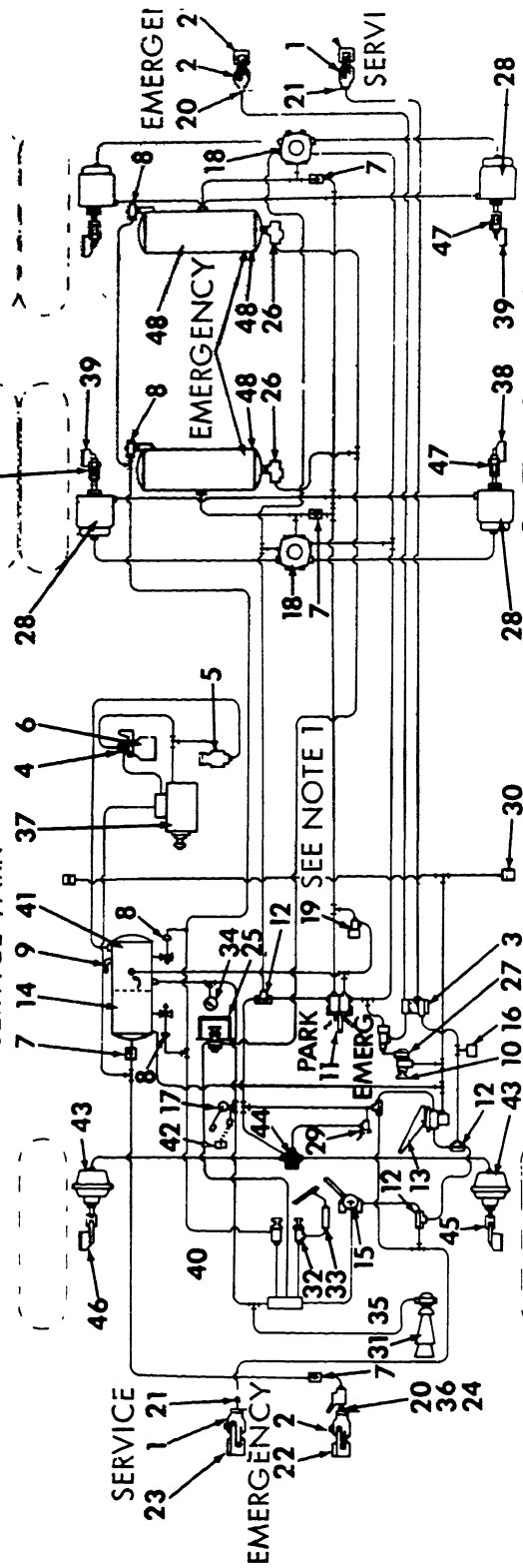
ME 3810-294-20/3-2

Figure 3-2. Carrier hydraulic steering system.

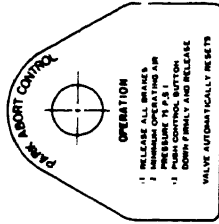
INSTRUCTIONS FOR ITEM 11



SERVICE PARK



INSTRUCTIONS FOR ITEM 25

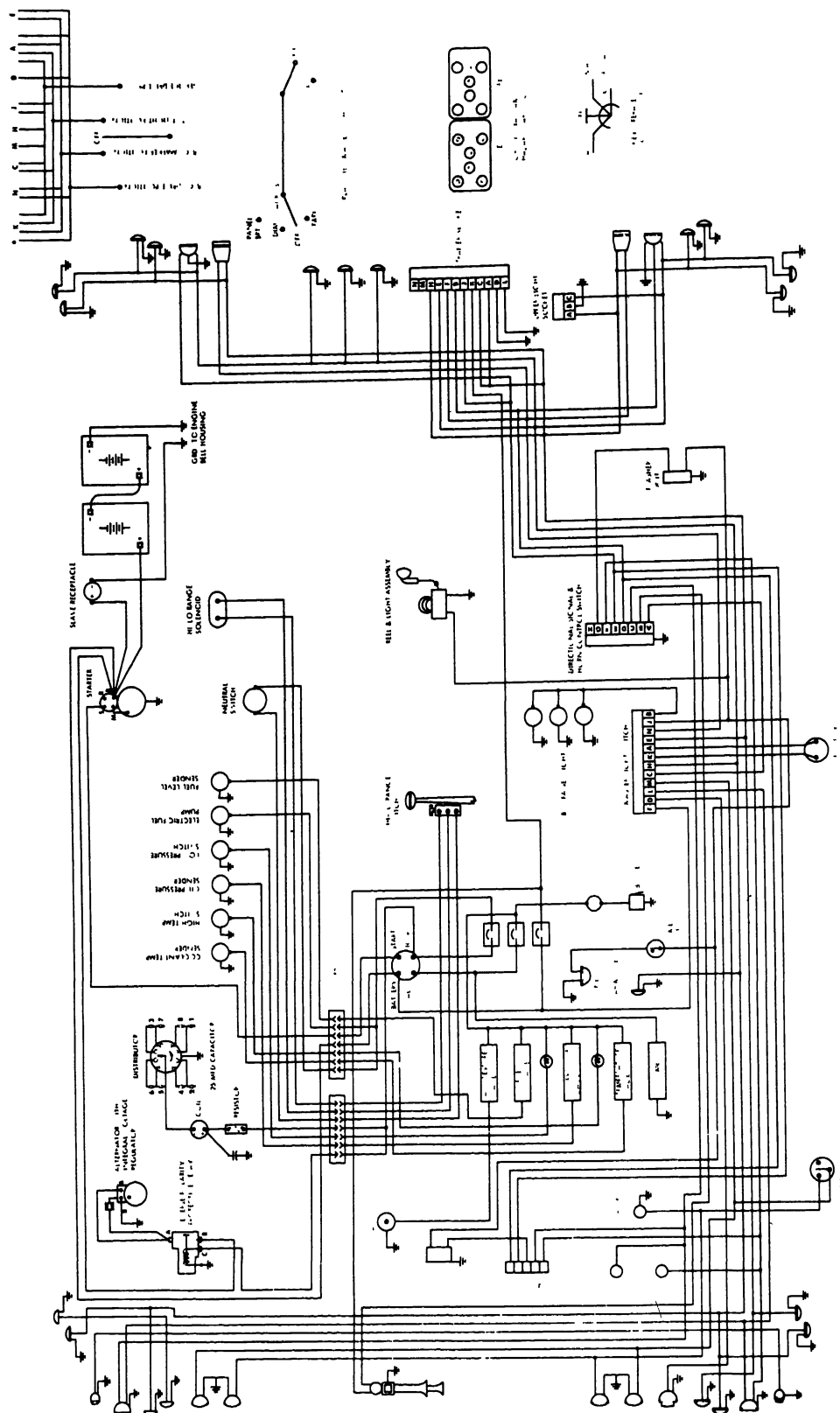


NOTES:

1. SET TO CLOSE AT 75 PSI.
2. VALVE (25) SHOWN IN "RELEASE" POSITION. OPERATE VALVE AS FOLLOWS:
 - A. NORMAL SYSTEM PRESSURE - PLACE LEVER IN "PARK". WHEN LOW PRESSURE SIGNAL COMES ON, DO NOT MOVE LEVER.
 - B. IF LOW PRESSURE SIGNAL IS ON BEFORE PARKING, DO NOT PLACE LEVER IN "PARK". PLACE LEVER IN "EMERGENCY".
 - C. TO RELEASE PARKING BRAKES OR RECHARGE SYSTEM, PLACE LEVER IN "EMERGENCY". CHARGE SYSTEM TO 100 PSI. THEN MOVE LEVER TO "RELEASE" POSITION.
3. VALVE (25) HAS A COVER TO PREVENT ACCIDENTAL ACTUATION. OPERATE THIS PARK ABORT CONTROL VALVE AS FOLLOWS:
 - A. RELEASE ALL BRAKES.
 - B. CHECK GAUGE (34) PRESSURE. IT MUST BE 75 PSI MINIMUM.
 - C. PUSH VALVE (25) BUTTON DOWN FIRM AND HOLD DEPRESSED FOR ONE MINUTE. THE VALVE AUTOMATICALLY RESETS AND IS RELEASED.

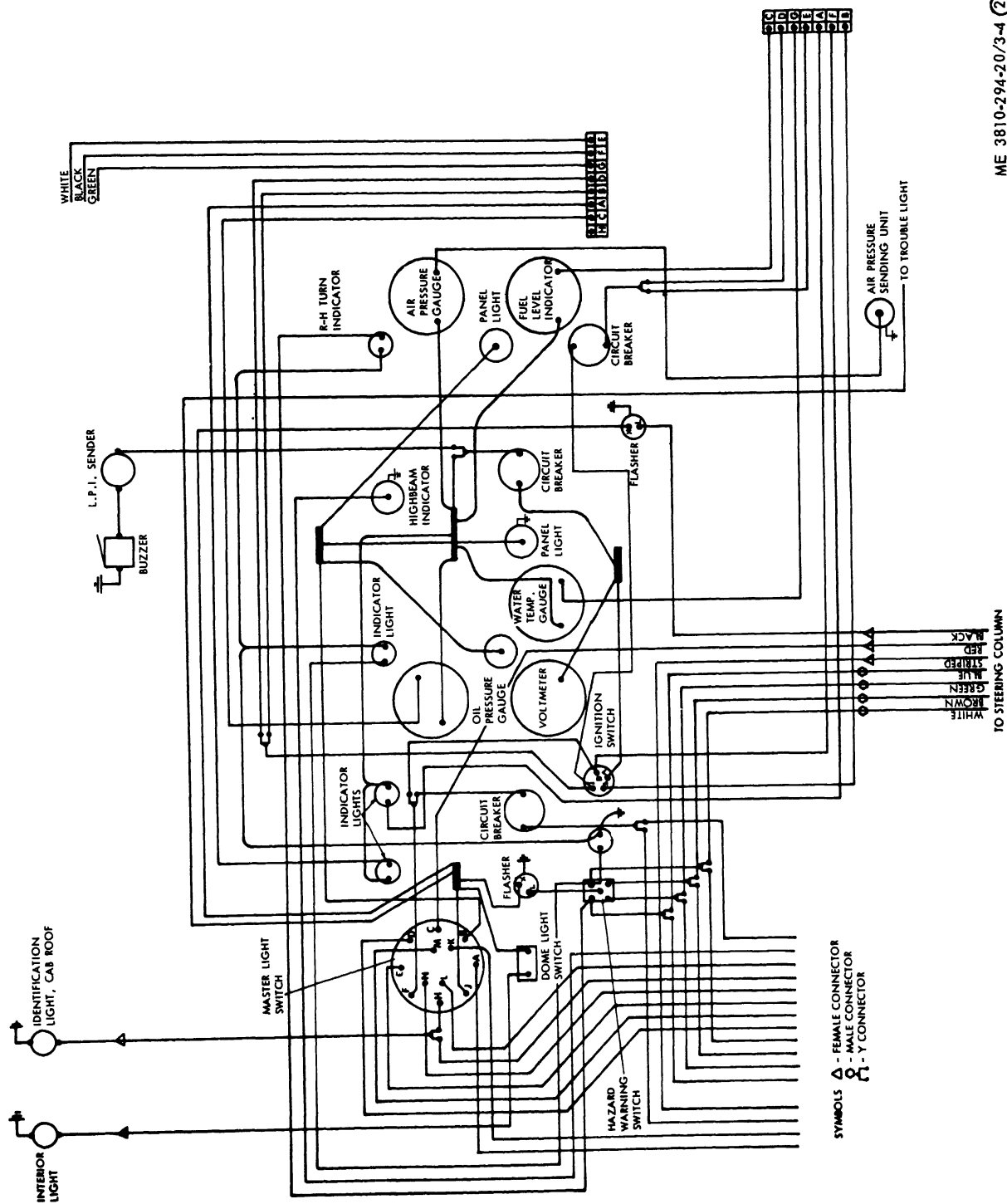
brake valve	25. PP-1 Valve (choke vent)	37. TU-FLO air compressor
2 Brake valve	26. AS-1 Control valve	38. Slack adjuster
light switch	27. SV-1 Valve (with choke fitting)	39. Slack adjuster
pressure indicator	28. SD-3 Brake chamber	40. HV-4 Drain valve
emergency valve	29. TW-1 Control valve	41. Reservoir (park)
Pressure protection	30. Coupling body	42. Low pressure indicator buzzer
gency tag	31. Air horn	43. Brake chamber
ee tag	32. Wiper control	44. Limiting and quick-release valve
ny coupling	33. Windshield wiper	45. Slack adjuster
ny coupling	34. Air gauge	46. Slack adjuster
ping stud	35. Junction block (manifold)	47. Mechanical release yoke
	36. Cut-out cock	48. Reservoir (emergency)

Figure 3-3 — Continued



ME 3810-294-20/3-4 ①

Figure 3-4. Carrier wiring diagram. (sheet 1 of 2)



ME 3810-294-20/3-4 (2)

Figure 3-4. Carrier wiring diagram. (sheet 2 of 2)

CHAPTER 4

MAINTENANCE INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIAL

4-1. Inspecting and Servicing the Equipment

Refer to paragraph 2-1 for instructions.

4-2. Installation

Refer to TM 5-3810-294-10 for installation instructions.

Section II. MOVEMENT TO A NEW WORKSITE

4-3. Dismantling for Movement

Refer to paragraph 2-10 for dismantling instructions.

4-4. Reinstallation after Movement

Refer to paragraph 2-11 for reinstallation instructions.

Section III. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

4-5. Tools and Equipment

Refer to paragraph 2-12 for tools and equipment.

4-7. Maintenance Repair Parts

Refer to TM 5-3810-294-20P.

4-6. Special Tools and Equipment

Special tools required to maintain the carrier are listed in Section III of Appendix B.

Section IV. LUBRICATION INSTRUCTIONS

4-8. General

Refer to TM 5-3810-294-10 for general lubrication information.

4-9. Detailed Lubrication Instructions

Refer to Lubrication Order, LO 5-3810-294-12

Section V. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-10. General

To insure that the carrier is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance checks and services to be performed are listed and described in paragraph 4-11. The item numbers indicate the sequence of minimum inspection requirements. Defects discovered during operation of the unit will be noted for future correction, to be made as soon as operation has ceased. Stop

operation immediately if a deficiency is noted during operation which would damage the equipment if operation were continued. All deficiencies and shortcomings will be recorded together with the corrective action taken on DA Form 2404 at the earliest possible opportunity

4-11. Preventive Maintenance Checks and Services

See table 4-1 for a tabulated listing of preventive maintenance checks and services.

Table 4-1. Organizational Preventive Maintenance Checks and Services

Q — Quarterly
Total man-hours required: 8.7

Sequence Number	ITEM TO BE INSPECTED PROCEDURE	
1	TRANSMISSION AIR FILTER Monthly, remove drain plug and blow out accumulated sediment. Quarterly, or each 400 operating hours, replace the filter.	.
2	FUEL SUPPLY Inspect fuel lines for leaks and tighten loose connections. Replace defective lines and fittings (para 4-39).	1.
8	RADIATOR Fill to 3/4-inch above baffle plate. Replace cracked or worn hose. Tighten all mounting clamps and connections (figs. 4-12 and 4-13).	1.
4	CRANKCASE OIL Add oil as indicated (fig. 4-34).	.
5	ENGINE DRIVE BELTS Adjust as required. Replace worn or frayed belts (para 4-47).	.
6	BATTERIES Check electrolyte level and specific gravity (1.285-1.300), using hydrometer, and tightness of connections. Fill to 3/8-inch (approx) above the plates. In freezing weather, run the engine for one hour after adding water. Clean vent hole in filler caps before installing caps. Replace a cracked or leaking battery (para 4-26).	.
7	ENGINE OIL FILTER Change filter elements and replace filter cover gaskets. Check for leaks and repair or replace defective external connections (para 4-60).	.
8	HYDRAULIC STEERING RESERVOIR Check level and add oil if necessary. Every six months remove reservoir, clean filter, and replace oil (fig. 4-44).	1.
9	SERVICE BRAKES Remove wheel. Inspect brake lining and replace brake shoes if lining is within 1/16-inch of rivets (para 4-80).	1.
10	ENGINE CLUTCH Adjust if necessary (para 4-67).	.

Section VI. TROUBLESHOOTING

4-12. General

a. This section contains troubleshooting information for locating and correcting troubles which may develop in the carrier that are within the scope of organizational maintenance. Each malfunction for an individual component, unit, or system is followed by a list of tests or inspections which will help you to determine probable causes of trouble and corrective actions to

take. You should perform the tests/and corrective actions in the order 1

b. This manual cannot list all m. that may occur, nor all tests or inspe corrective actions. If a malfunction is or is not corrected by listed correcti notify your supervisor.

4-13. Troubleshooting

Refer to table 4-2.

1. ENGINE WILL NOT CRANK

- Step 1. Test batteries.
Replace defective batteries (para 4-26).
- Step 2. Check starter relay.
Replace defective relay (para 4-50).

2. ENGINE CRANKS BUT WILL NOT START

- Step 1. Check for open primary ignition circuit.
Tighten primary lead at distributor (para 4-51). Clean dirty ignition points; replace defective points (para 4-51). Repair open ignition switch circuit (para 4-51).
- Step 2. Check for grounded primary ignition circuit.
If insulator on primary lead is cracked, replace lead (para 4-54). Adjust ignition points (para 4-51). Replace defective capacitor (para 4-51).
- Step 3. Check for faulty secondary ignition circuit.
Clean spark plug cable terminals. If cable insulation is broken or cracked, replace cable (para 4-53). Clean dirty spark plugs; replace defective plugs (para 4-53). If distributor cap is cracked, replace cap (para 4-51). If rotor is cracked or rotor contact arm broken, replace rotor.
- Step 4. Check fuel pump.
Replace faulty fuel pump (para 4-41).
- Step 5. Check carburetor adjustment.
Adjust carburetor (para 4-40).

3. ENGINE MISFIRES

- Step 1. Check spark plugs for fouled plug or cracked porcelain.
Clean or replace plugs (para 4-53).
- Step 2. Check for burned or pitted ignition points.
Replace points (fig. 4-51).
- Step 3. Check for incorrect ignition point gap.
Adjust points (para 4-51).

4. ENGINE IDLES ROUGH

- Step 1. Check carburetor adjustment.
Adjust carburetor (para 4-40).
- Step 2. Check ignition point gap for gap too narrow or much too wide.
Adjust points (para 4-51).
- Step 3. Check intake manifold for leaks.
Repair or replace defective manifold (para 4-56).

5. ENGINE FAILS TO REACH OPERATING TEMPERATURE

- Step 1. Check for thermostat stuck open or removed from vehicle.
Replace defective thermostat (para 4-36).
- Step 2. Check for defective temperature sending unit or engine control panel gage.
Replace defective unit (para 4-24 or 4-20).

6. ENGINE OVERHEATS

- Step 1. Check for loose water pump V-belt.
Adjust V-belt (para 4-47).
- Step 2. Check water pump.
Replace defective water pump (para 4-46).
- Step 3. Check for collapsed or clogged hoses.
Replace hoses (para 4-36).
- Step 4. Check for defective thermostat.
Replace thermostat (para 4-36).
- Step 5. Check for clogged or leaky radiator.
Replace radiator (para 4-35).

Table 4-2. Troubleshooting—Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 6.	Check for engine oil leak at filter or at any external piping. Replace leaky oil filter or piping (para 4-59 and 4-60).
7. LOW OIL PRESSURE		
	Step 1.	Check for loose connections in oil lines. Tighten connections (para 4-60).
	Step 2.	Check for clogged oil filter. Replace oil filter (para 4-59).
	Step 3.	Check for oil too thin due to dilution or too light a grade used. Drain crankcase and refill with proper oil (para 4-58).
	Step 4.	Check oil pressure sender. Replace faulty oil pressure sender (para 4-24).
8. HIGH OIL PRESSURE		
	Step 1.	Oil too heavy. Drain crankcase and refill with proper oil (para 4-58).
	Step 2.	Check for defective oil pressure gage on engine control panel. Replace oil pressure gage (para 4-20).
9. EXCESSIVE OIL CONSUMPTION		
	Step 1.	Check oil lines for leaks at connections. Tighten loose connections (para 4-60).
	Step 2.	Check for poor quality or wrong grade of oil. Drain crankcase and refill with proper oil (para 4-58).
10. ENGINE LACKS POWER		
	Step 1.	Test fuel pump operation. Replace defective fuel pump (para 4-41).
	Step 2.	Check for dirty or faulty carburetor. Clean or replace carburetor (para 4-40).
	Step 3.	Check spark plugs. Replace faulty spark plugs (para 4-53).
	Step 4.	Check for burned, pitted, or sticking ignition points. Replace defective points (para 4-51).
11. BATTERIES DISCHARGE WITH ENGINE RUNNING		
		Check for loose alternator V-belt or faulty alternator. Adjust V-belt tension or replace faulty alternator (para 4-49).
12. ENGINE TENDS TO STALL AT FULL LOAD		
		Check fuel pump. Repair or replace defective fuel pump (para 4-41).
13. ENGINE "CUTS OUT" QUITE SUDDENLY UNDER LOAD		
	Step 1.	Check fuel line for restriction. Replace defective fuel line (para 4-39).
	Step 2.	Check fuel pump. Repair or replace defective fuel pump (para 4-41).
14. ENGINE EXHAUST IS SMOKY		
	Step 1.	If exhaust is black, check for faulty spark plugs or ignition timing. Replace faulty plugs (para 4-53); adjust ignition timing (para 4-51).
	Step 2.	If exhaust is blue, the engine is burning oil due to leaking oil into exhaust manifold or blow-by past piston rings. Refer to direct support maintenance.
15. ENGINE CLUTCH OVERHEATS OR JUMPS OUT OF ENGAGEMENT		
		Check clutch adjustment. Adjust clutch (para 4-67).

16. INCORRECT AIR BRAKE SYSTEM PRESSURE

- Step 1. Check compressor.
Replace defective compressor (para 4-90).
- Step 2. Check governor pressure range setting.
Adjust governor (para 4-90).

17. BRAKES GRAB OR VEHICLE TENDS TO TURN WHEN BRAKES ARE APPLIED

- Step 1. Check for improper brake adjustment.
Adjust brakes (para 4-80).
- Step 2. Check for worn brake linings.
Replace brake shoes (para 4-80).

18. INCORRECT ALTERNATOR VOLTAGE

- Check alternator.
Replace faulty alternator (para 4-49).

19. LIGHTS FAIL

- Step 1. Check for defective or burned out lamps
Replace lamps (para 2-51).
- Step 2. Check for defective wiring.
Repair or replace wiring (para 2-55).
- Step 3. Check for defective switch.
Replace switch (para 2-55).
- Step 4. Check for faulty ground.
Clean ground terminals (foldout 3-4)

20. POWER STEERING IS "SPONGY" AND MAKES "GROANING" SOUND

- Step 1. Check for low fluid level.
Add fluid (para 4-70)
- Step 2. Check power steering pump.
Replace faulty pump (para 4-70)

21. HARD STEERING (VEHICLE MOVING)

- Check for clogged filter.
Clean filter or replace reservoir (para 4-70).

22. HARD STEERING (VEHICLE STANDING STILL)

- Step 1. Check for loose or glazed pump belt.
Adjust or replace belt (para 4-47).
 - Step 2. Check for worn tires
Replace badly worn tire (para 4-87)
-

Section VII. RADIO INTERFERENCE SUPPRESSION

4-14. General Methods Used to Obtain Proper Suppression

Essentially, suppression is obtained by providing a low resistance path to ground for stray currents. The methods used include shielding the ignition wires, grounding with bonding straps, and using capacitors and resistors.

4-15. Interference Suppression Components

The primary suppression components are those whose primary function is to suppress radio interference. On this machine, the primary inter-

ference suppression components are the (microfarad capacitor mounted on the side of ignition coil and the 0.450 - 0.475 ohm resistor illustrated in figure 4-1.

4-16. Replacement of Suppression Components

Refer to figure 4-1 and replace the radio interference suppression resistor and capacitor. Refer to figure 4-32 and replace secondary radio suppression components, which are spark plug lead and the lead from the distributor to the ignition coil.

4-22. Trailer Coupling and Wiring Harness

a. General. There are two trailer couplings on the machine. One is mounted on the rear of the carrier frame and the other is mounted directly behind the first, on the rear of the outrigger box.

b. Removal and Replacement. The method of removing and replacing both couplings is the same. Refer to figure 4-3 and remove and replace the trailer couplings.

c. Harness Repair. The methods used to repair this harness are identical to those described in paragraph 2-50.

4-23. Lights

a. Replacement. Refer to paragraph 2-51 for information concerning replacement of lights.

b. Repair of Wiring.

(1) Refer to the schematic diagram of the carrier wiring, figure 3-4, to isolate wiring problems.

(2) Refer to paragraph 2-50 for the method to be used for wiring harness repair.

4-24. Sending Units, Warning Lights, and Switches

a. General. The sending units and associated lights and switches provide visual indications of developing troubles.

b. Oil Temperature Sender. Refer to figure 4-4, disconnect electrical lead and unscrew and replace a faulty oil temperature sender. Drain oil below the level of the sender before removal.

c. Water Temperature Sender. Open radiator drain cocks and drain coolant level below the level of the water temperature sender. Refer to figure 4-5, disconnect electrical lead, and un-

screw and replace the water temperature sender if it tests faulty.

d. Oil Pressure Sender. Drain engine below the level of the pressure sender. Refer to figure 4-6, disconnect the electrical lead, and unscrew and replace a faulty oil pressure sender.

4-25. Horn Replacement

a. General. The horn is used to warn personnel of machine movement which might endanger their safety.

b. Removal. Refer to figure 4-7 and remove the horn button as follows:

(1) Twist the horn button and emblem plate counterclockwise. Remove contact cup spring. Remove the screws in the base plate assembly and remove the plate.

(2) Remove wheel nut and wheel. Completely pull the horn contact roller assembly off of the steering column.

c. Replacement. Refer to figure 4-7 and reassemble the horn button as follows:

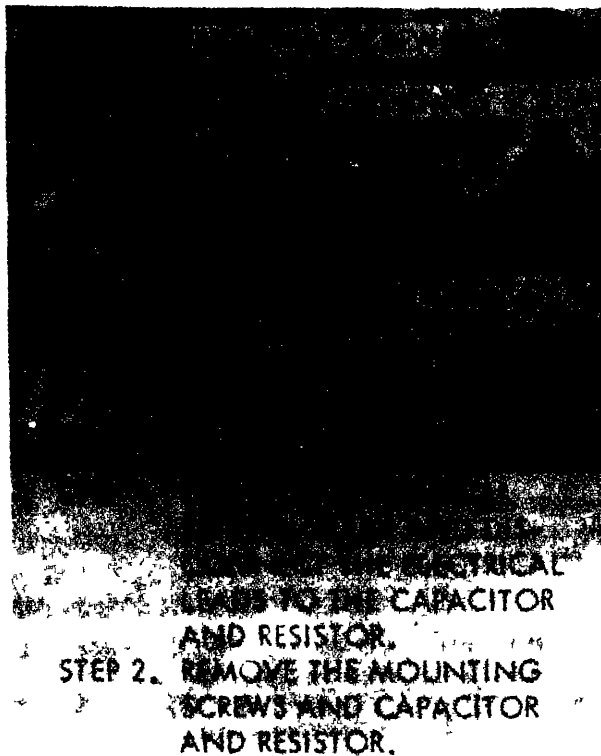
(1) Insert the wire on the horn contact roller assembly through opening in turn signal housing and down through wire trough in jacket tube. Press horn contact roller assembly into turn signal housing.

(2) Install wheel and wheel nut. Tighten the wheel nut to 55-65 foot pounds.

(3) Assemble the spring, contact cup, horn button and emblem plate by pushing down with palm of hand and turning clockwise.

4-26. Batteries and Cables

Maintenance of carrier batteries and cables is identical to maintenance of crane batteries and cables. Refer to paragraph 2-53 for method of testing, replacing, and repairing the carrier batteries and batteries.



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Figure 4-1 Radio interference suppression resistor and capacitor, removal and replacement.

Section VIII. MAINTENANCE OF CARRIER CAB ELECTRICAL SYSTEM AND MISCELLANEOUS ITEMS

4-18. General

a. This section contains instructions for maintenance of the carrier cab wiring harness, engine control panel switches, gages and lamps, lights, sending units, horn, batteries, and miscellaneous items.

b. The carrier has a 24-volt, negative-ground, electrical system. Refer to figure 3-4 for the schematic wiring diagram.

WARNING

Always disconnect battery cables before working on electrical components.

4-19. Wiring Harness

Refer to paragraph 2-50 for wiring harness re-

4-17. Testing of Radio Interference Suppression Components

a. *Capacitor.* Test the capacitor for shorts on a capacitor tester. Replace defective capacitor.

b. *Ignition Leads.* If an ohmmeter is available, test for continuity. The approximate resistance of ignition leads should be in the area of 2000 ohms per inch of length. Any lead which tests substantially different from other leads.

c. *Isolation of Fault.* If test equipment is available and interference is indicated, isolate the cause of interference by the trial-and-error method of replacing the capacitor or ignition lead, in turn, until the cause of interference is found and corrected.

4-20. Engine Control Panel Switches, and Lamps

a. *General.* Figure 4-2 illustrates the control gages and instruments available to the operator. Refer to TM 5-3810-294-1 for the description and function of each.

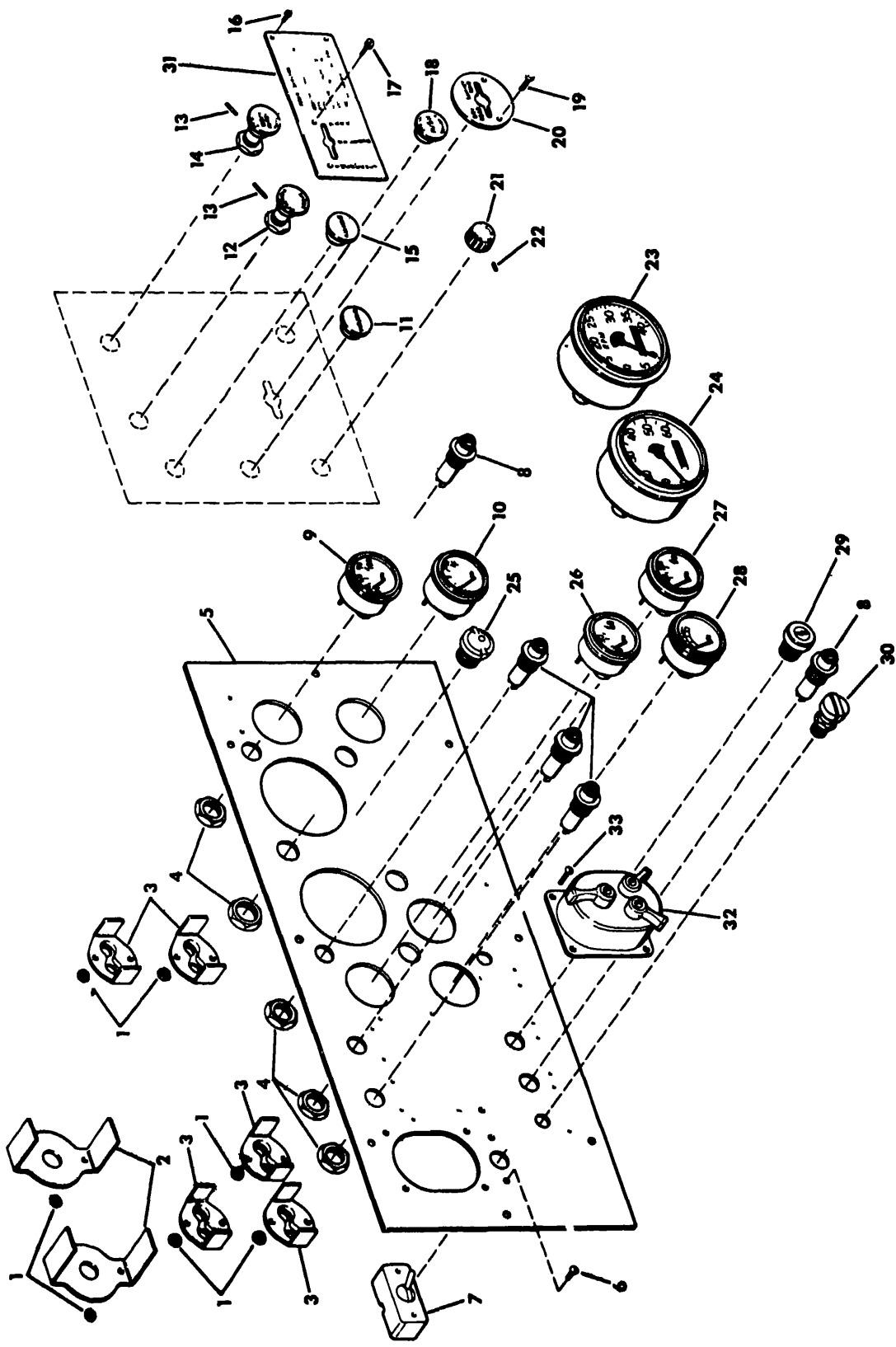
b. *Replacement.* Refer to figure 4-3 for the location of the control panel. Replace a damaged or faulty component on the control panel.

CAUTION

Always disconnect battery cables before working on the control panel.

4-21. Slave Cable Receptacles and Connectors

Refer to paragraph 2-52 for slave receptacle and connector maintenance.



- | | | | |
|----------------------|-------------------------------|----------------------------|---------------------------|
| 1. Nut | 10. Fuel gage | 19. Screw | 28. Voltmeter |
| 2. Bracket | 11. Throttle knob | 20. Instruction plate | 29. Ignition switch |
| 3. Bracket | 12. Reservoir drain knob | 21. Windshield wiper knob | 30. Hazard warning switch |
| 4. Nut | 13. Pin | 22. Setscrew | 31. Instruction plate |
| 5. Plate | 14. Air brake knob | 23. Tachometer-hourmeter | 32. Lamp selector switch |
| 6. Screw | 15. Choke knob | 24. Speedometer-odometer | 33. Screw |
| 7. Cab light switch | 16. Screw | 25. Hi-beam lamp | |
| 8. Lamp | 17. Screw | 26. Oil pressure gage | |
| 9. Air pressure gage | 18. Differential lockout knob | 27. Water temperature gage | |

Figure 4-2 --- Continued

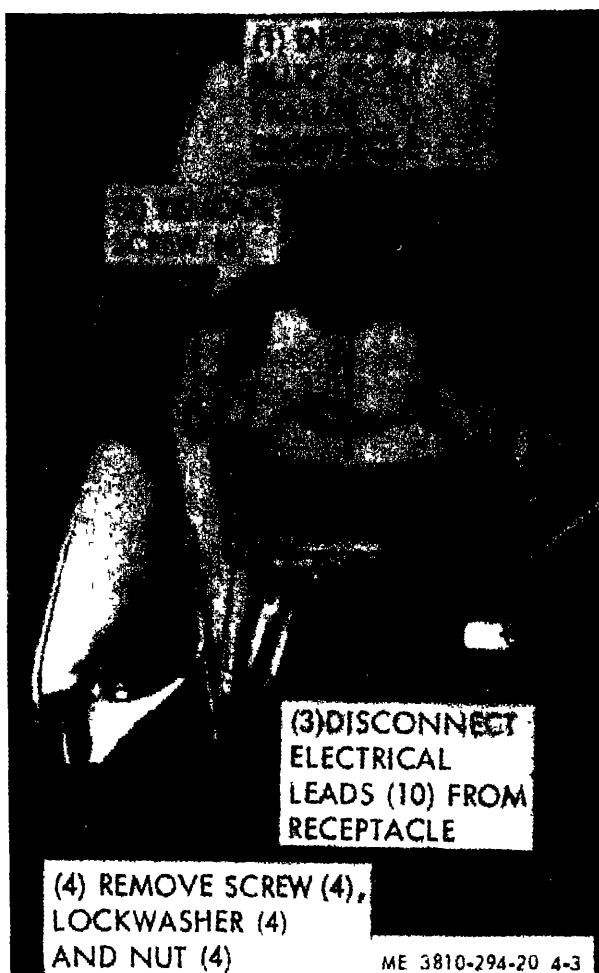


Figure 4-3 Trailer coupling, removal and replacement.

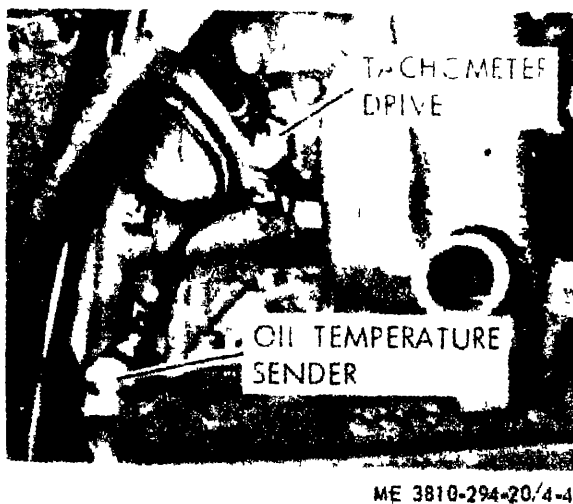


Figure 4-4. Oil temperature sender, removal and replacement.

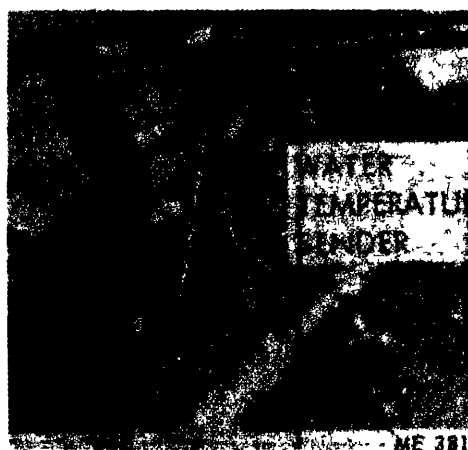


Figure 4-5. Water temperature sender, removal and replacement.

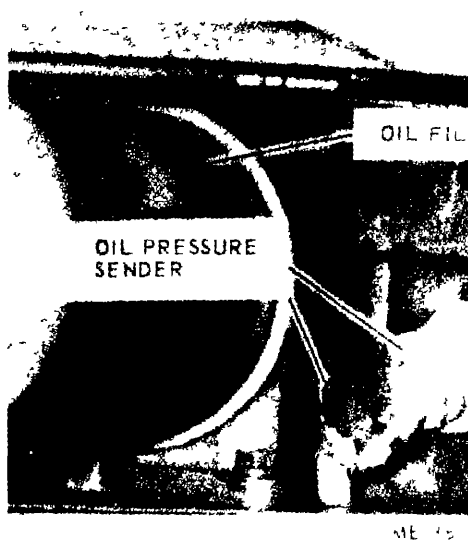
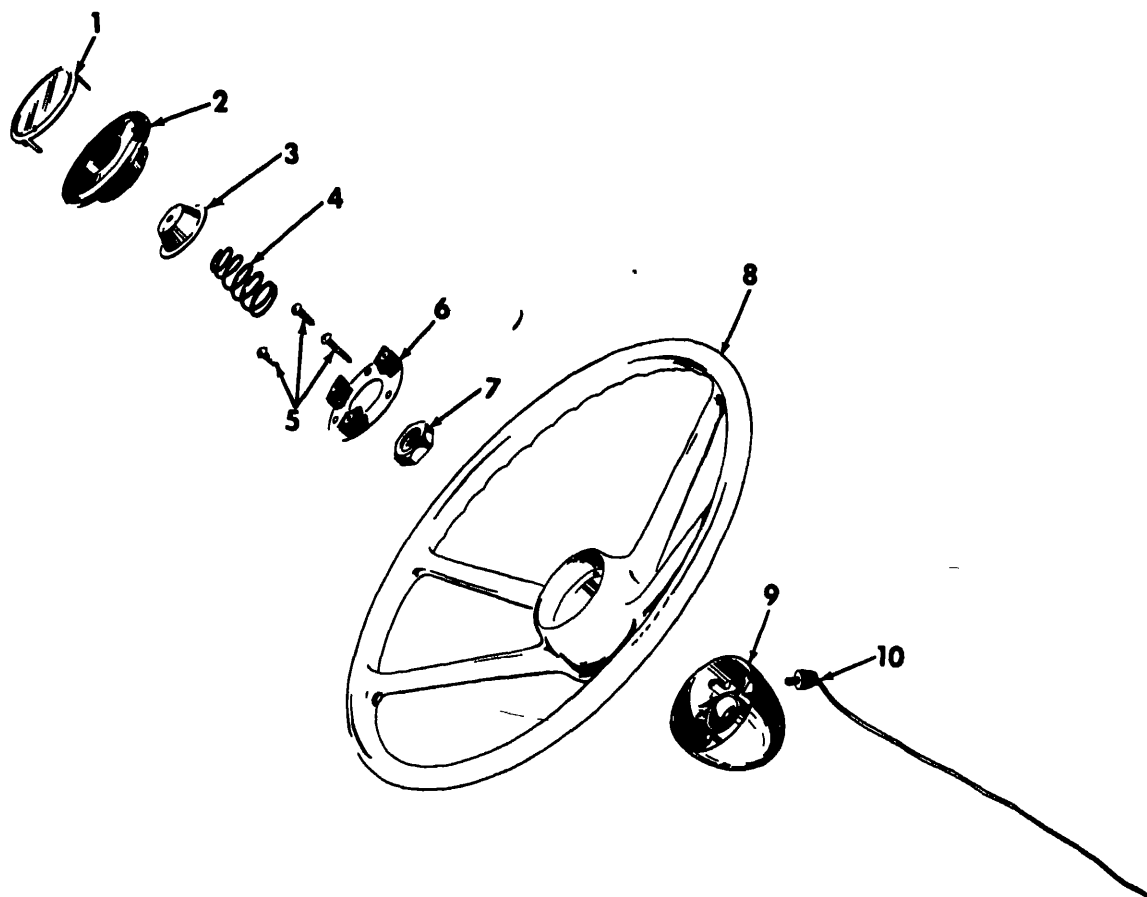


Figure 4-6. Oil pressure sender, removal and replacement.



- | | |
|------------------------|----------------------------------|
| 1. EMBLEM PLATE | 7. WHEEL NUT |
| 2. HORN BUTTON | 8. WHEEL |
| 3. CONTACT CUP | 9. TURN SIGNAL HOUSING |
| 4. SPRING | 10. HORN CONTACT ROLLER ASSEMBLY |
| 5. METAL TAPPING SCREW | |
| 6. BASE PLATE ASSEMBLY | |

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Figure 4-7. Horn button, removal and replacement.

Section IX. MAINTENANCE OF CAB AND ACCESSORY ITEMS

4-27. General

This section contains instructions for removal and replacement of the window glass, operator's seat, body sheet metal, and fenders.

4-28. Window Glass

Refer to paragraph 2-62 for glass removal and installation instructions.

4-29. Operators Seat

a. Removal. Refer to figure 4-8 and remove

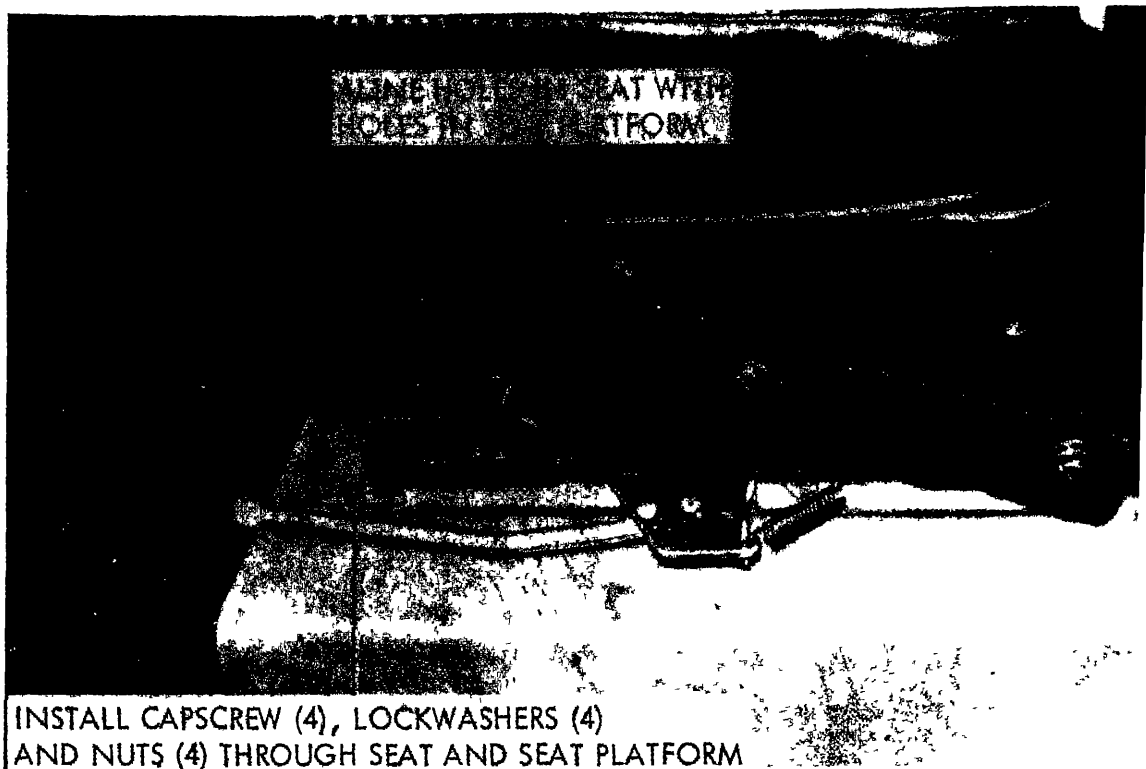
the capscrews, lockwashers, and nuts and move the seat.

b. Installation. Refer to figure 4-8 and install the seat as shown.

4-30. Cab Sheet Metal and Fenders

a. Refer to figure 4-9 and remove and replace any damaged cab sheet metal.

b. Refer to figure 4-9 and remove or install the fenders.



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Figure 4-8. Seat installation.

4-31. Engine Hood Assembly

Refer to figure 4-10 and remove or replace the engine hood assembly.

4-32. Windshield Wipers

a. Motor Replacement. Figure 4-11 shows the location of the windshield wiper motor. Before replacing a wiper motor which is apparently not operating properly, check system air pressure. Air pressure in the reservoir which supplies the wiper motor must be above 95 psi or there will be no air available for running the wiper motor since this is a low air condition. To remove the wiper motor, remove the wiper arm nut, disconnect the two air supply lines and the vent

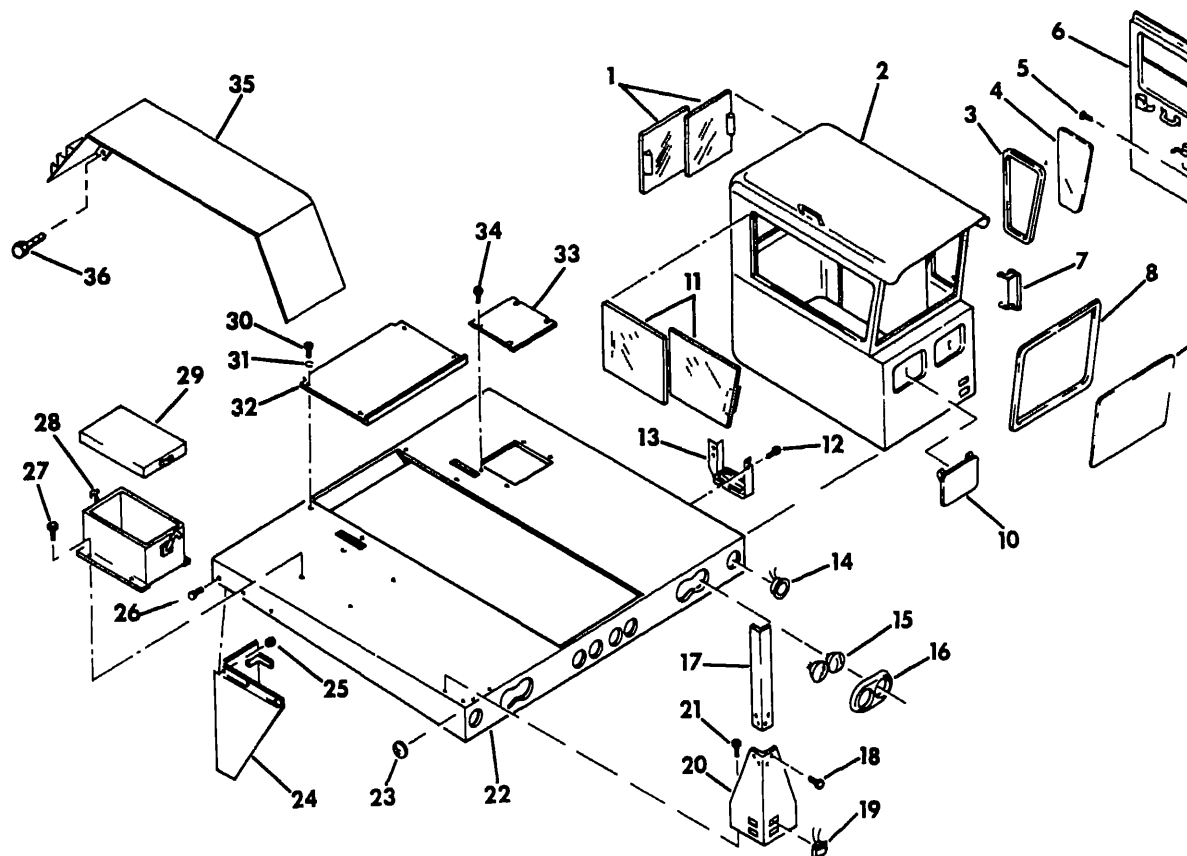
line, remove the motor bolts, and wiper motor.

b. Blade Replacement. Refer to figure 4-12 and remove the blade nut and replace the wiper blade.

c. Low Air Pressure Valve. Figure 4-13 shows the position of the low air pressure valve. If the air pressure is below safe operating pressure, remove the low air pressure valve, disconnect the air line and remove the attaching nut.

4-33. Data Plates

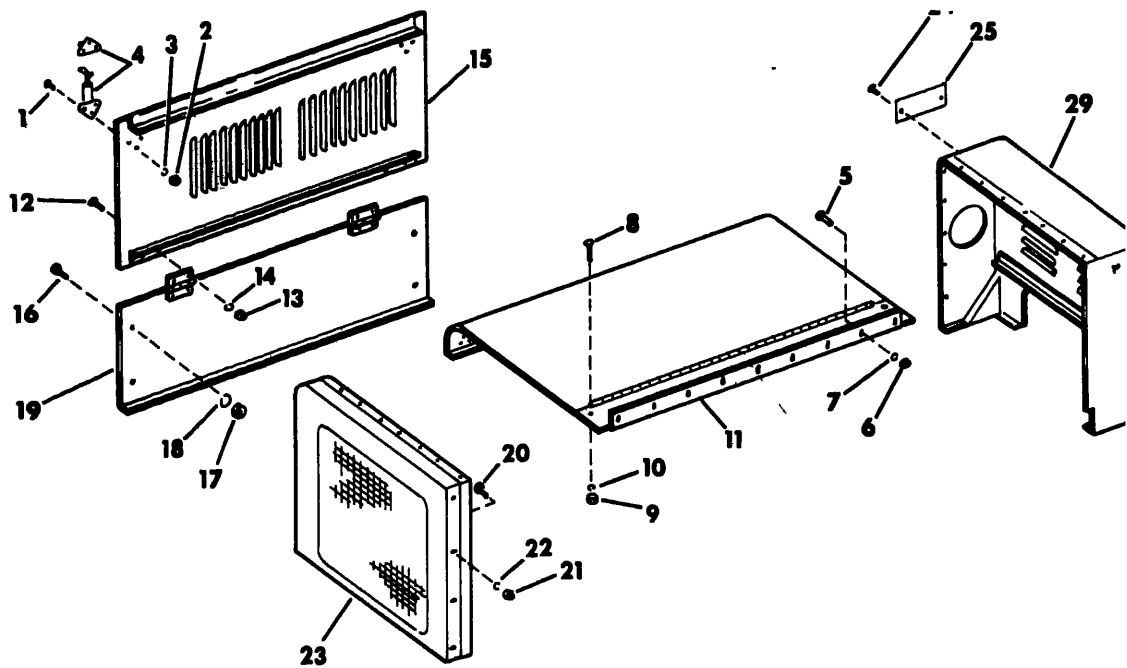
Refer to paragraph 2-117 for data plate location and replacement instructions.



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- | | | |
|---------------------|---------------------------------|---------------------------|
| 1. Window, rear | 13. Ladder bracket | 25. Nut |
| 2. Cab | 14. Park and directional lamp | 26. Capscrew |
| 3. Weatherstripping | 15. Headlight | 27. Capscrew |
| 4. Window | 16. Headlamp door | 28. Battery box |
| 5. Capscrew | 17. Mirror stand | 29. Cover |
| 6. Door assembly | 18. Capscrew | 30. Capscrew |
| 7. Vent door | 19. Running and blackout lights | 31. Lockwasher |
| 8. Weatherstripping | 20. Mirror mounting base | 32. Access cover |
| 9. Window | 21. Capscrew | 33. Seat mounting bracket |
| 10. Vent door | 22. Platform | 34. Capscrew |
| 11. Window | 23. Reflector | 35. Rear fender |
| 12. Capscrew | 24. Platform skirt | 36. Capscrew |

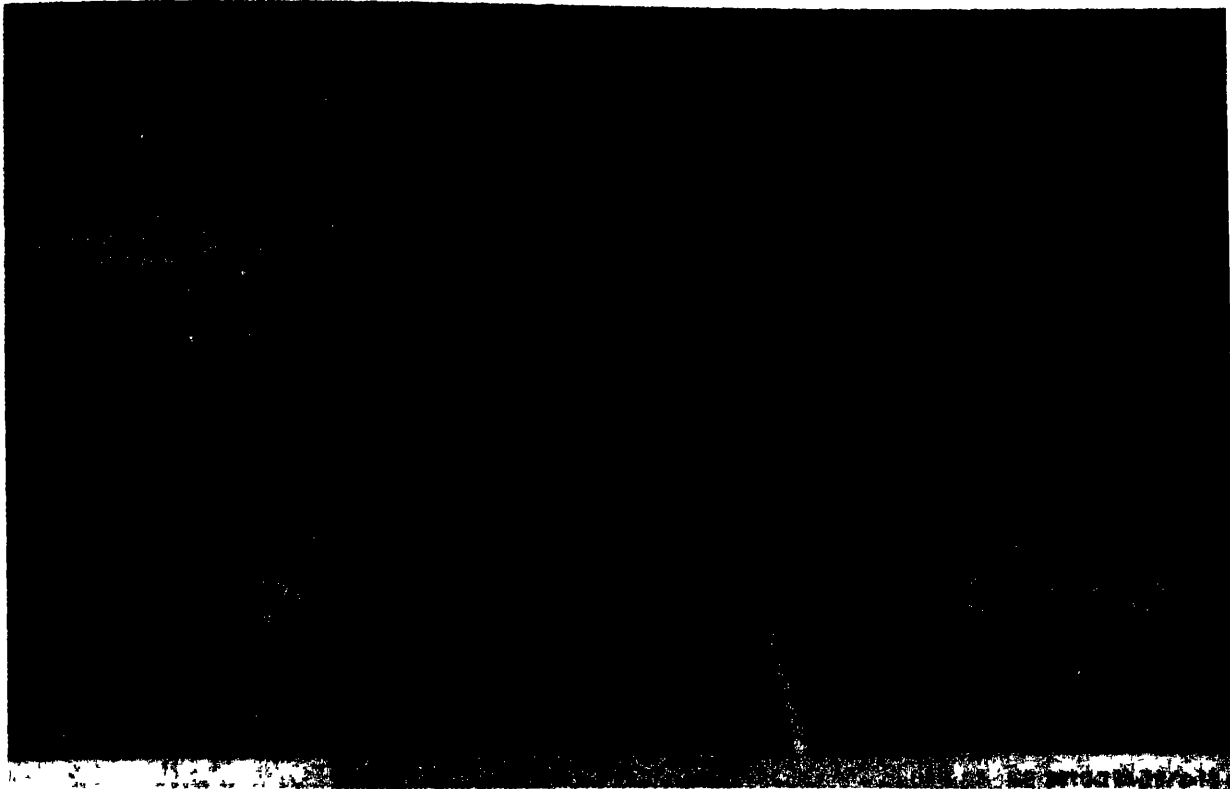
Figure 4-9. Carrier cab assembly, exploded view.



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- | | | |
|--------------------------|--------------------------|---------------------------|
| 1. Machine screw (12) | 11. Top panel (1) | 21. Nut (9) |
| 2. Nut (12) | 12. Capcrew (12) | 22. Lockwasher (9) |
| 3. Lockwasher (12) | 13. Nut (4) | 23. Center front rail (1) |
| 4. Fastener Assembly (2) | 14. Lockwasher (4) | 24. Screw (2) |
| 5. Capcrew (2) | 15. Upper side panel (1) | 25. Information plate (1) |
| 6. Nut (5) | 16. Machine screw (4) | 26. Capcrew (5) |
| 7. Lockwasher (5) | 17. Nut (4) | 27. Lockwasher (5) |
| 8. Machine screw (2) | 18. Lockwasher (4) | 28. Nut (5) |
| 9. Nut (5) | 19. Lower side panel (1) | 29. Rear panel (1) |
| 10. Lockwasher (2) | 20. Capcrew (9) | |

Figure 4-10. Engine hood assembly, removal and replacement.



*Figure 4-11. Windshield wiper motor, removal and replacement.
(sheet 1 of 2)*



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Figure 4-11 Windshield wiper motor, removal and replacement. (sheet 2 of 2)

Section X. MAINTENANCE OF COOLING SYSTEM

4-34. General

This section contains instructions for maintenance of the radiator and hoses, lines, and fittings as allocated by the maintenance allocation chart.

4-35. Radiator and Cap

a. *General.* The radiator is of the pressurized fin and tube type. Flow is from top to bottom. See figure 4-12.

b. Radiator Cap.

(1) *Test.* The radiator cap is rated at 7 psi. If the cap is suspected of leaking, test it on a cap tester, if available.

(2) *Replacement.* If the cap is leaking and no radiator cap pressure tester is available, remove the radiator cap and install a new cap rated at 7 psi.

c. Radiator Removal.

(1) Refer to figure 4-12 and drain the coolant from the system.

(2) Refer to figure 4-51 and remove the alcohol evaporator and the two radiator hoses. The evaporator is mounted on one of the radiator hoses.

(3) Remove the windshield wiper motor, container and hoses. Refer to figure 4-11 for removal of the engine hood sheet metal.

(5) Refer to figure 4-51 and install alcohol evaporator.

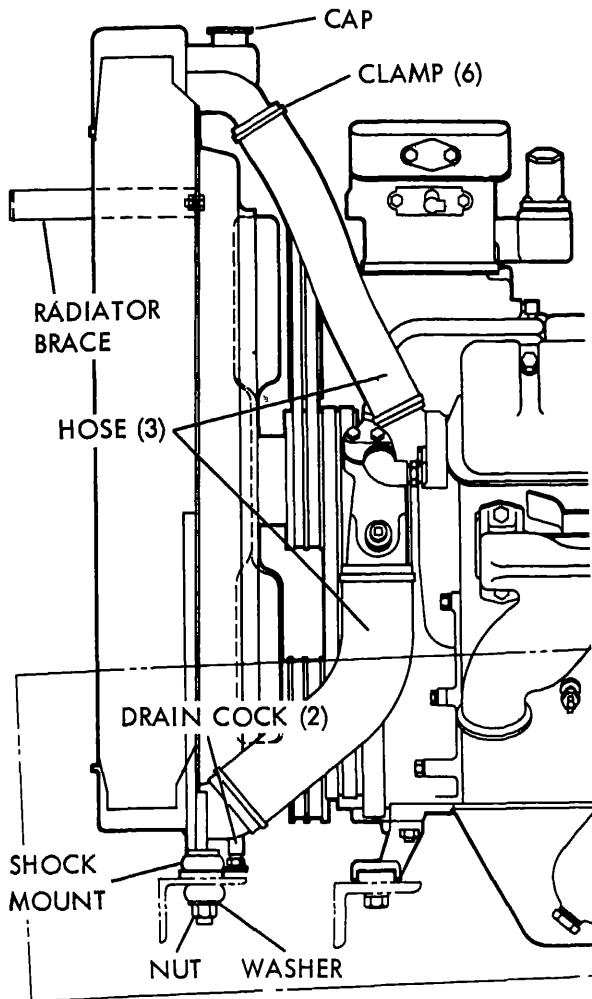
(6) Refill the cooling system.

4-36. Thermostat and Housing

a. General. There are two thermostats and two housings furnished on this engine, as shown in figure 4-13. The thermostats are of the pass type, and one is located in each cylinder bank. Removal, test, inspection, and replacement procedures apply equally to each thermostat.

b. Inspection. Inspect the connections to radiator and thermostat housings for leaks, the thermostat housing gasket for leaks. Replace faulty hoses or gaskets. When the engine has been run for a period of time long enough to insure that it is warmed up to normal operating temperature, check oil and water temperatures as shown on the gauges on the operator's control panel. If water or oil temperatures show too high or too low, one of the possible causes of trouble may be the thermostats.

c. Removal. Drain the coolant below the level of the thermostat housings. Refer to figure 4-12 for the location of the drain cock. Then remove the thermostats and housings as follows:



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Figure 4-12. Radiator removal and replacement.

(4) Refer to figure 4-12, loosen the hose clamps and remove the three radiator hoses.

(5) With the radiator adequately braced, refer to figure 4-12 and remove mounting nuts, lockwashers, plain washers, shock mounts, and stud spacers. Attach a suitable lifting device, take out all slack, and remove the radiator.

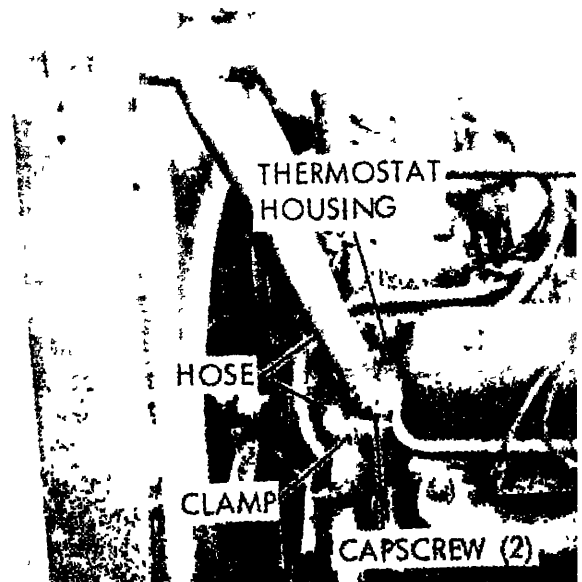
d. Radiator Installation.

(1) Refer to figure 4-12 using a suitable lifting device, install the radiator, the two radiator braces, and the lower shock mount material.

(2) Connect the radiator hoses.

(3) Install the windshield washer fluid container and hoses.

(4) Refer to figure 4-10 and install the hood sheet metal.



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Figure 4-13. Thermostat housings, removal and replacement.

(1) Remove hose clamps and disconnect both hoses at the thermostat housing to be removed.

(2) Remove the two capscrews which secure thermostat housing to the cylinder block. Tap the housing with a small plastic hammer to loosen the housing.

(3) Refer to figure 4-14 and remove the thermostats from the housing and discard thermostat housing gasket and thermostat seal.

d. Testing. Refer to paragraph 2-85 and test the thermostat in the manner described.

e. Installation.

(1) Place a thermostat seal in the groove of the thermostat on the end of the thermostat marked TOP.

(2) Insert the thermostat into the housing with the end marked TOP leading.

(3) Install a new thermostat housing gasket.

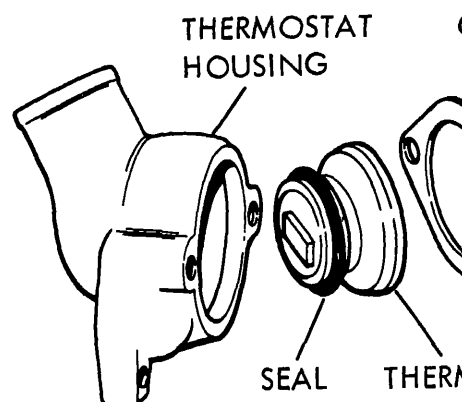
(4) Place the thermostat housing on the gasket and secure with the two capscrews and lockwashers.

(5) Connect the upper radiator hose to the thermostat housing.

(6) Repeat the five steps above for other thermostat and housing.

(7) Close drain cocks (fig. 4-15) and fill the system with coolant.

(8) Inspect for leaks with the system running.



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Figure 4-14. Thermostat, removal and installation.

Section XI. MAINTENANCE OF ENGINE FUEL SYSTEM

4-37. General

The engine fuel system consists of the tank, lines and fittings, the fuel pump, air cleaner, fuel filter, accelerator control, and the throttle and choke controls. In addition, the distributor (para 4-51) and the carburetor are designed to function together as a governor. The governor portion of the distributor consists of a spinner valve positioned by the distributor shaft. The spinner valve supplies air to a diaphragm unit attached to the carburetor throttle body to provide governing action.

4-38. Air Cleaner

a. General. The engine air cleaner input air passes from the top down through a centrally located tube to an oil filled cup. The cup splash lubricates a removable filter element, through which air must pass on its way to the outlet tube. Contaminants and air borne particles are removed when they stick to the lubricated removable element.

b. Removal. Refer to figure 4-15 and remove the air cleaner as follows:

(1) Loosen the hose clamps and slide the hose off the engine air intake pipe. Remove the

screws, lockwashers, and nuts securing the halves of the bands.

(2) Spread the bands and remove the air cleaner.

c. Installation. Refer to figure 4-15 and place the air cleaner as follows:

(1) Spread the bands enough to allow the air cleaner to be installed as shown.

(2) Secure the bands with nuts and screws as shown.

(3) Slide the flexible hose over the pipes and tighten the hose clamps.

4-39. Fuel Tank, Lines, and Fittings

a. General. The fuel tank is situated beneath the carrier deck, just behind the front wheel of the carrier. It contains a fuel gauge which indicates the level of fuel. The fuel gauge is located on the operating control panel.

b. Tank Removal and Replacement. Refer to figure 4-16 and remove and replace the fuel tank.

c. Fuel Lines and Fittings.

(1) *Repair.* Clean all accessible fuel lines in figure 4-17. Replace any damaged lines. Tighten any loose or leaking connections.

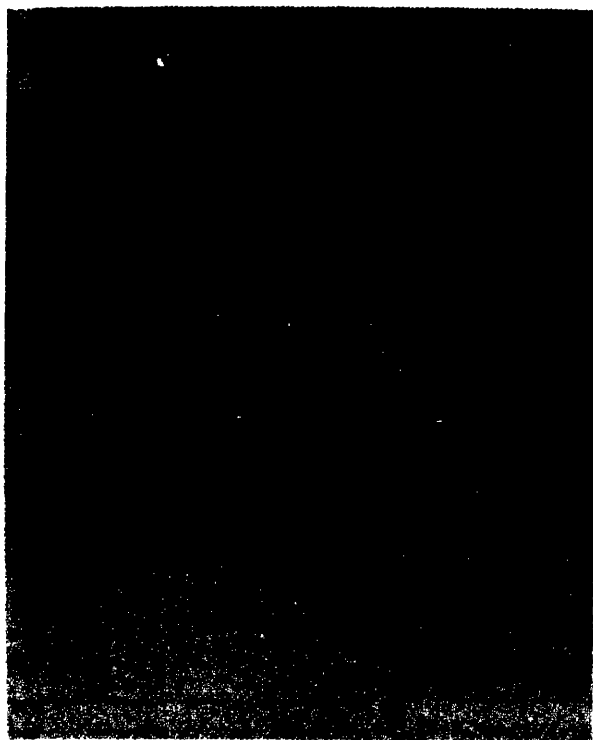


Figure 4-15. Engine air cleaner, removal and replacement.

(2) *Replacement.* Refer to figure 4-17 and replace any damaged items.

4-40. Carburetor

a. General. The carburetor is a four-barrel concentric downdraft type unit. It differs from other carburetors in that it has two additional or secondary barrels which operate only during periods of heavy engine loads. Throttle plates in the secondary barrel are vacuum operated. The carburetor is similar to the dual-concentric type carburetor in that it has two primary barrels each of which contain a venturi, main fuel discharge nozzle, throttle plate, idle passages, and choke plate. A throttle operated accelerator pump supplies added fuel for engine acceleration. It also has a power enrichment system which automatically comes into effect whenever an added amount of fuel is needed for full power operation. The governor assembly used is integral with the carburetor and is also vacuum operated.

b. Removal.

(1) Refer to figure 4-18, remove the fuel line to the carburetor and immediately plug the line.

(2) Disconnect the choke, throttle, and governor lines to the carburetor.

(3) Disconnect and remove air intake tubing to the carburetor.

(4) Remove the nuts and lockwashers which secure the carburetor to the intake manifold and remove the carburetor as an assembly.

c. Installation.

(1) Place the carburetor on the intake manifold and secure with nuts and lockwashers, figure 4-18.

(2) Remove fuel line plug installed when carburetor was removed and connect fuel line to carburetor.

(3) Refer to figure 4-18 and connect choke and throttle linkage and the governor air and vacuum lines.

(4) Connect air cleaner tubing to carburetor.

(5) Before returning engine to service, adjust carburetor as described below.

d. Adjustment.

(1) Before adjusting the carburetor, be sure that ignition timing is correct and that break point gap is properly adjusted. See paragraph 4-64. Be sure spark plugs are properly gapped as instructed in paragraph 4-72. Be sure that all carburetor flange bolts are secure and that there are no leaks at gaskets.

(2) Run the engine until it reaches normal operating temperature.

(3) Set engine idle speed at approximately 350-to 400-rpm using throttle stop screw, figure 4-18.

(4) Turn one of the two idle adjusting screws in (clockwise) until engine speed begins to drop.

(5) Turn the same idle adjusting screw in the opposite (counterclockwise) direction, counting the turns, until engine speed again begins to drop.

(6) Return the idle adjusting screw to midway point.

(7) Repeat the process with the second idle adjusting screw. Each adjusting screw should be turned the same amount. Therefore, it may be necessary to repeat the above procedure to obtain best results. If available, a vacuum gauge may be used to obtain the highest possible steady vacuum reading.

(8) Refer to figure 4-18 and place the accelerating pump link in the hole most distant from the throttle shaft for cold weather operation. Use the hole nearest the throttle shaft for warm weather operation.

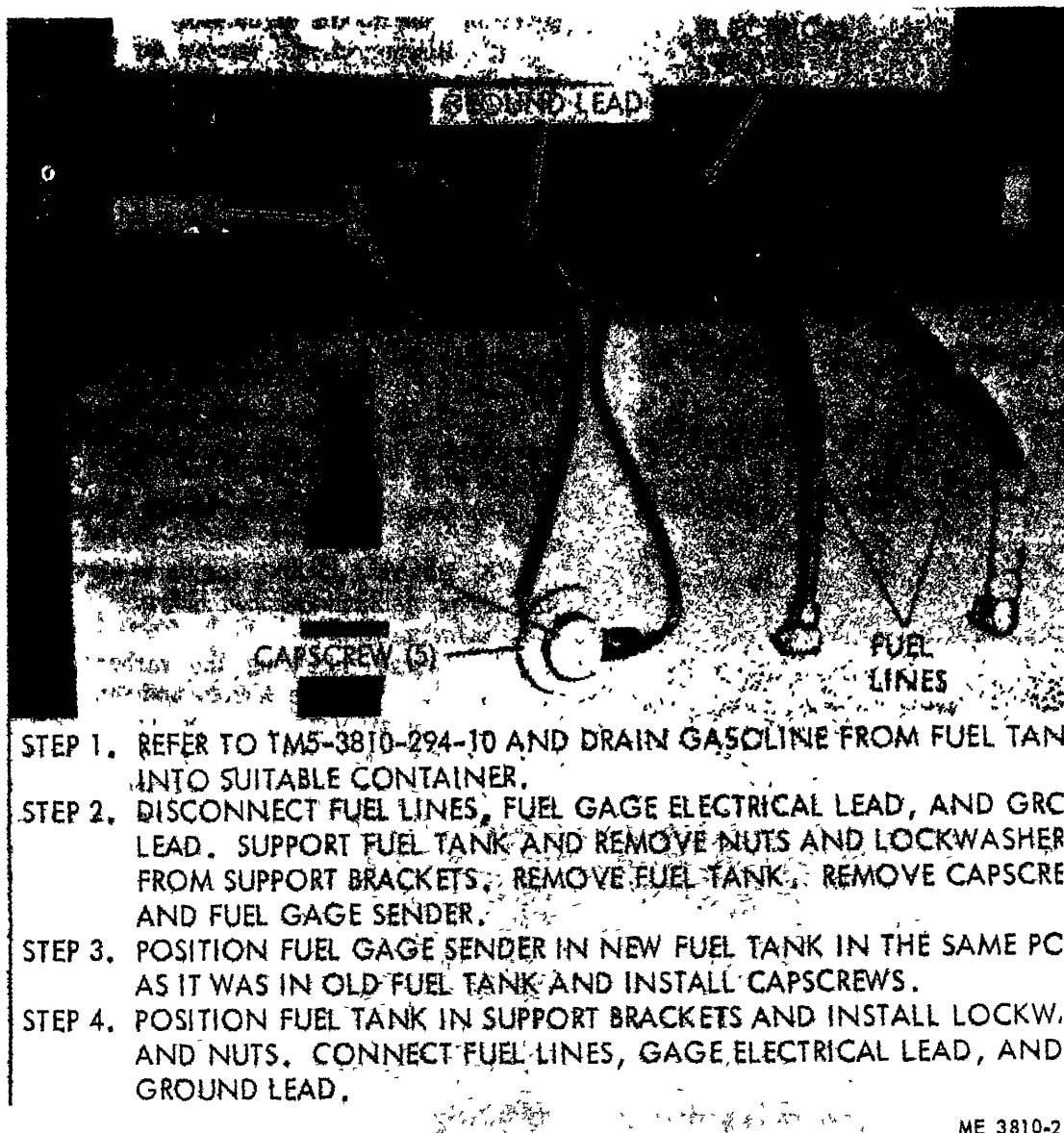


Figure 4-16. Fuel tank, removal and replacement.

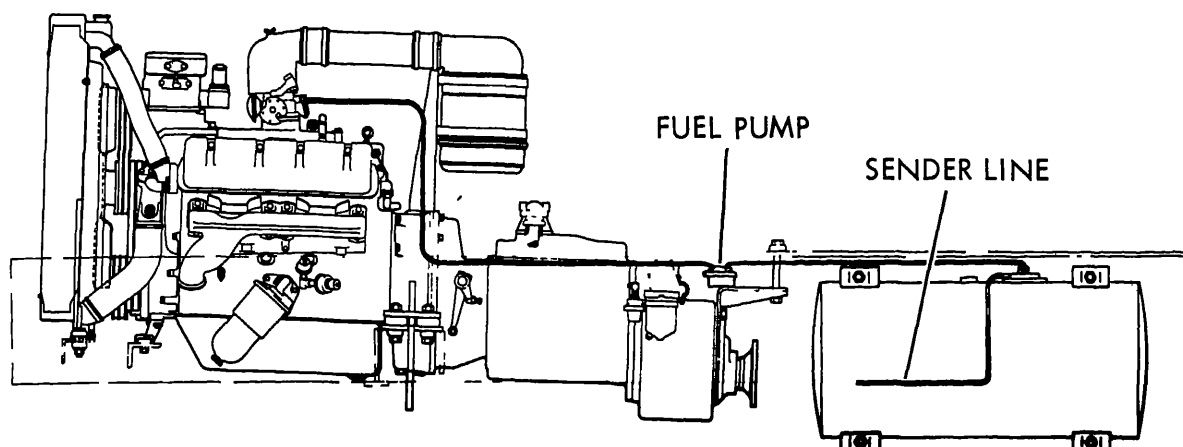
4-41. Fuel Pump and Filter

a. *General.* The fuel pump is mounted on the frame behind the engine fuel tank and is electrically operated. It is designed with a solenoid which, when energized, causes the movement of a hollow plunger in a cylindrical bore. The plunger stroke is controlled by a set of interrupter type contact points in the pump electrical circuit. The contact points function in a sealed section of the pump body which contains an inert gas to prevent arcing and prolong point life. If any of the electrical components of the pump

become inoperative, it is necessary to replace the complete pump since the inert gas is lost when the pump body is opened.

(1) When the solenoid is energized, the plunger spring which is seated on the (or check) valve in the bottom of the plunger opens the check valve in the plunger opening, allowing passage of fuel through the plunger and internal tube to the top of the pump body where it is trapped by the check valve.

(2) When the contacts open, the plunger is caused by upward plunger movement. When the solenoid is deenergized, the plunger spring



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Figure 4-17. Fuel lines and fittings, replacement and repair.

turns the plunger to the top of the cylinder at a fixed rate to provide the required fuel pressure. During the upward movement of the plunger, the check valve in the plunger is held closed by pressure above the valve, and fuel is forced into the fuel system. However, the check valve in the bottom of the cylinder bore is open, thus permitting fuel to enter the bore of the cylinder for the next cycle, which starts when the plunger reaches a predetermined point in the tube.

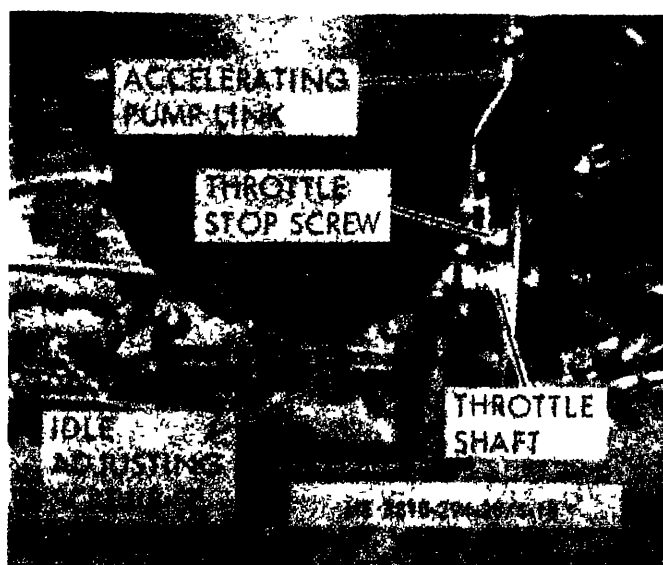


Figure 4-18. Carburetor adjustment, removal, and replacement.

(3) A pulsation dampener in the top of pump provides steady operation and even pressure in the output line. The pump also incorporates a pressure relief system to assure an immediate return to zero fuel pressure when ignition is turned off. The filter system is contained in the lower portion of the pump and consists of a filter element and a magnet. The pump mounting bracket serves as the ground connection. The pump must be provided with a good electrical ground. The pump contains a special suppression capacitor to prevent radio frequency interference.

b. *Test* If the carburetor floods at engine idling speed or if flooding occurs with the ignition switch turned on and the engine is running, examine the engine carburetor for needle valve and seat for wear or foreign matter on the valve or seat. While the ignition is on, the pump continues to operate in order to maintain constant pressure, even after the carburetor float needle valve closes. The following could also adversely affect pump operation:

- (1) Poor ground connection.
- (2) Poor battery-to-ground connection.
- (3) Loose electrical connections anywhere in the circuit.
- (4) Air leaks in lines or at fittings.
- (5) Kinked or clogged lines which restrict fuel flow.

c. *Service.* Service must be limited to the filter element area since the electrical portion

sealed in inert gas. Service the filter element as follows:

(1) Refer to figure 4-19 and remove the pump from the vehicle. Immediately cap all fuel lines. Use a 5/8-inch wrench to release the bottom pump cover from the pump body. The wrench may be placed on the hexagon on the bottom of the cover.

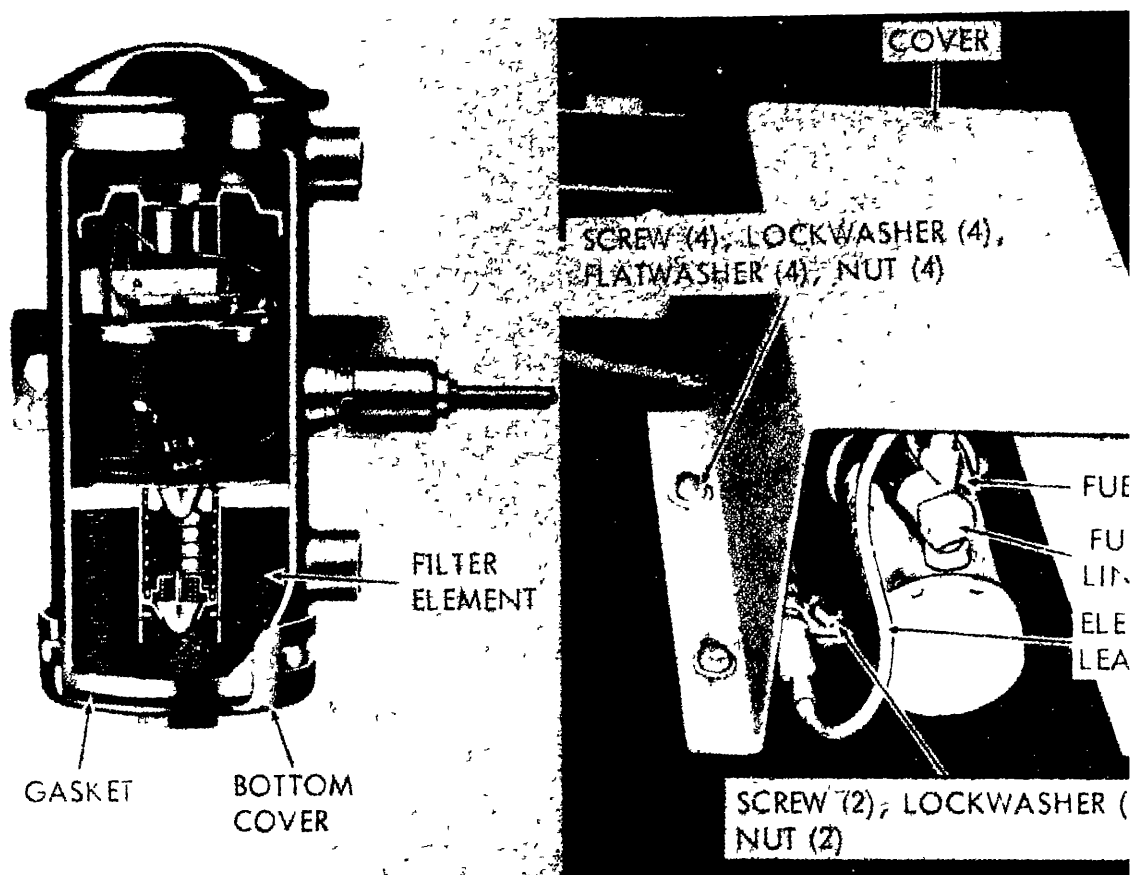
(2) Remove the filter element, magnet, and cover gasket. Wash the filter element and blow out with clean dry compressed air. Check the cover gasket and replace it if it is deteriorated or damaged. Clean the cover.

d. *Removal and Replacement.* Refer to figure 4-19 and remove or replace the fuel pump.

4-42. Accelerator and Throttle Control

a. *General.* These controls act on the principle, which is to control the amount of fuel mixture which reaches the engine while the engine is running. Both controls are connected to the engine. The throttle control can be used to maintain constant engine fuel input while the control is used to vary engine speed.

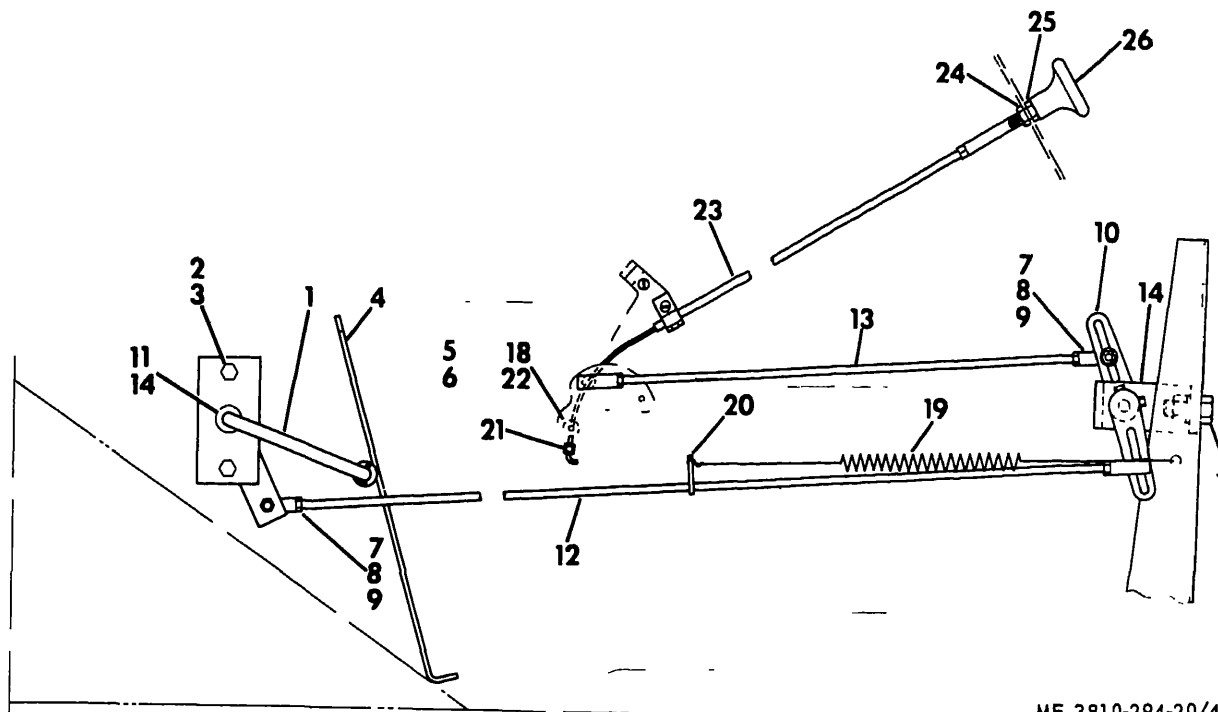
b. *Removal, Replacement, and Repair.* Refer to figure 4-20 and remove, replace, or repair a faulty component of the throttle controls.



- STEP 1. REMOVE BOTTOM COVER, GASKET, AND FILTER ELEMENT. WASH FILTER ELEMENT IN CLEANING SOLVENT AND BLOW OUT WITH COMPRESSED AIR.
- STEP 2. INSTALL GASKET IN BOTTOM COVER. INSTALL FILTER ELEMENT IN FUEL PUMP AND INSTALL BOTTOM COVER.

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Figure 4-19. Fuel filter service and fuel pump removal and replacement.



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- | | | |
|------------------------|----------------|--------------------|
| 1. Rod | 10. Crank arm | 19. Spring |
| 2. Nut with lockwasher | 11. Pin | 20. Spring clip |
| 3. Washer | 12. Rod | 21. Trunnion |
| 4. Pedal, accelerator | 13. Rod | 22. Washer |
| 5. Washer | 14. Bracket | 23. Throttle cable |
| 6. Cotter pin | 15. Capscrew | 24. Nut |
| 7. Ball joint | 16. Lockwasher | 25. Nut |
| 8. Nut | 17. Nut | 26. Throttle knob |
| 9. Lockwasher | 18. Clamp | |

Figure 4-20. Accelerator and throttle control, removal, replacement, and repair.

Section XII. MAINTENANCE OF EXHAUST SYSTEM

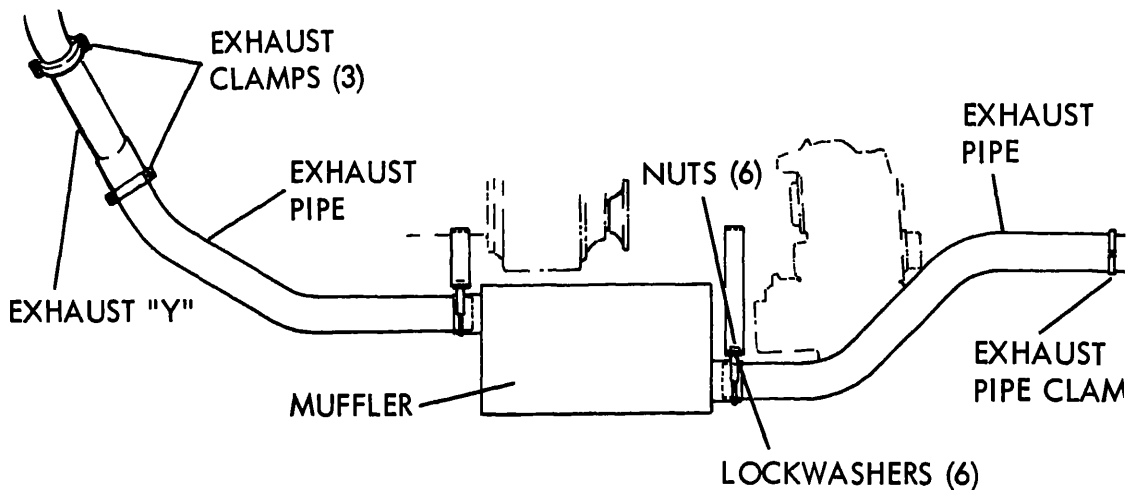
4-43. General

This section contains maintenance instructions for the exhaust pipes and muffler (fig. 4-21) as allocated by the maintenance allocation chart.

4-44. Muffler and Pipes Replacement

a. *Removal* Refer to figure 4-21 and re exhaust pipes and muffler.

b. *Installation.* Refer to figure 4-21 and stall exhaust pipes and muffler.



- STEP 1. REMOVE THREE EXHAUST CLAMPS.
- STEP 2. BLOCK MUFFLER AND EXHAUST PIPE IN POSITION. REMOVE NUTS, LOCKWASHERS FROM MUFFLER AND EXHAUST PIPE CLAMPS. REMOVE MUFFLER AND EXHAUST PIPES, AND SEPARATE PIPES FROM MUFFLER.
- STEP 3. ASSEMBLE EXHAUST PIPES AND MUFFLER. POSITION MUFFLER AND EXHAUST PIPES ON CARRIER. INSTALL MUFFLER AND EXHAUST PIPE CLAMPS.

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Figure 4-21. Exhaust pipes and muffler, removal and replacement.

Section XIII. MAINTENANCE OF FAN AND WATER PUMP

4-45. General

The water pump is built into the engine front end cover and supplies both cylinder banks. The coolant flows from the radiator directly to the cylinder heads. An idler pulley provides the means of adjusting the two water pump and fan pulley belts.

4-46. Water Pump and Idler Pulley

a. *Removal.* Remove the water pump and idler pulley as follows:

- (1) Drain the cooling system. Refer to figure 4-12.
- (2) Refer to paragraph 4-35 and remove the radiator.
- (3) Refer to figure 4-22 and remove the fan from the fan pulley as shown by removing the six attaching screws and lockwashers.
- (4) Loosen alternator belt tension adjusting screw at the alternator front mounting bracket.
- (5) Loosen the water pump idler pulley adjusting screws. Remove the two belts which drive the alternator and the two belts which are behind them on the fan pulley.

(6) Refer to figure 4-23 and remove water pump and gasket as follows:

- (a) Remove the six mounting lockwashers.
- (b) Remove water pump assembly.
- (c) Remove gasket.

(7) Refer to figure 4-23 and remove water pump idler pulley as follows:

- (a) Remove adjusting screw and two washers beneath.
- (b) Remove mounting screw and spacer beneath and remove bracket. All parts will come off on bracket as bracket will be free.

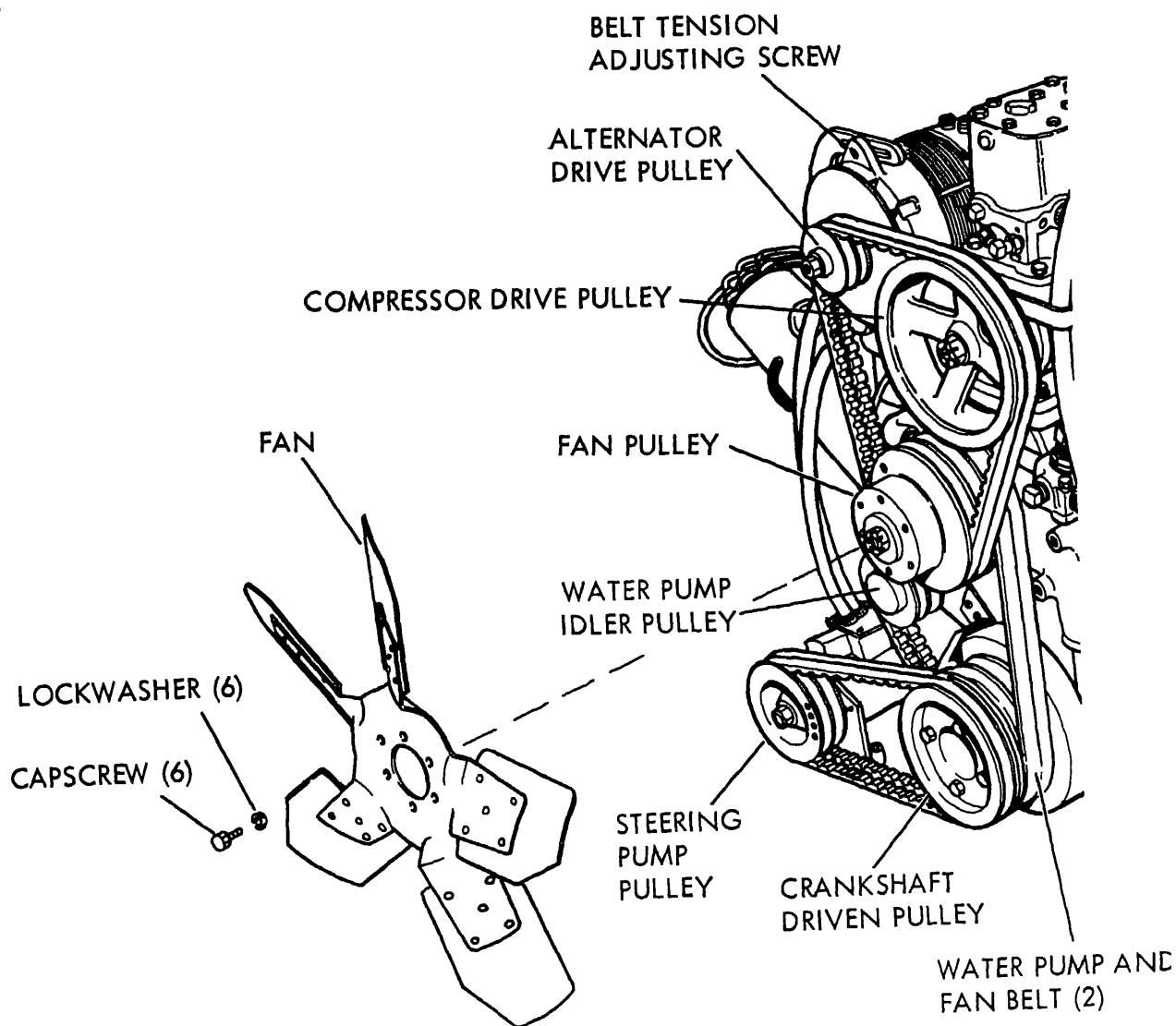
b. *Replacement.*

(1) Refer to figure 4-23, install gasket and place pump in position on engine cover.

(2) Secure pump in place with mounting screw and lockwashers.

(3) Install all parts as an assembly with mounting screw, washer, and spacer.

(4) Loosely install adjusting screw and lockwashers beneath.



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Figure 4-22. Engine belt and pulley arrangement, removal and replacement.

(5) Install the water pump belts over the fan pulley and water pump idler pulley and adjust belt tension as shown in figure 4-24. Refer to figure 4-24 and install and adjust alternator belts.

(6) Refer to figure 4-22 and install the fan on the water pump hub.

(7) Refer to paragraph 4-35 and install the radiator.

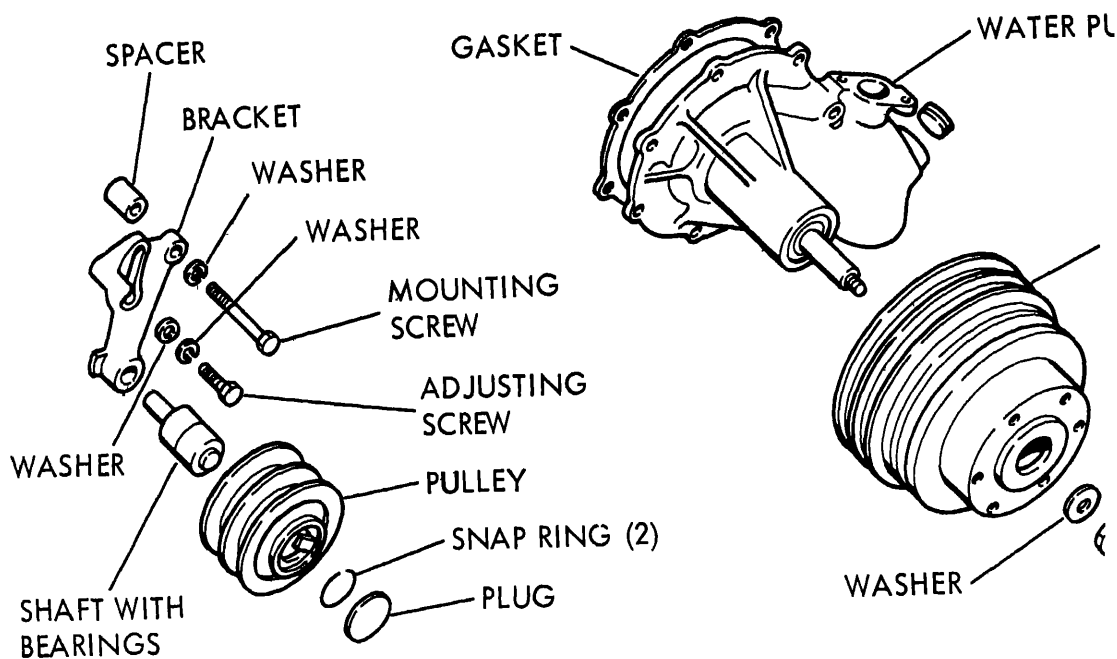
4-47. Fan, Pulley, and Belts

a. General. The belt arrangement for this engine is shown in figure 4-22. The water pump,

water pump idler, and fan pulleys are driven two belts from the crankshaft pulley. Two additional belts from the fan pulley drive the alternator and air compressor. If it is necessary, for any reason, to remove the water pump pulley which the fan is mounted, the radiator must be removed as described in paragraph 4-35.

b. Service. All pump, pulley, and idler bearings are lubricated at assembly and require further lubrication. Therefore, service consists of periodic inspection and replacement of belts and belt tension adjustments as required.

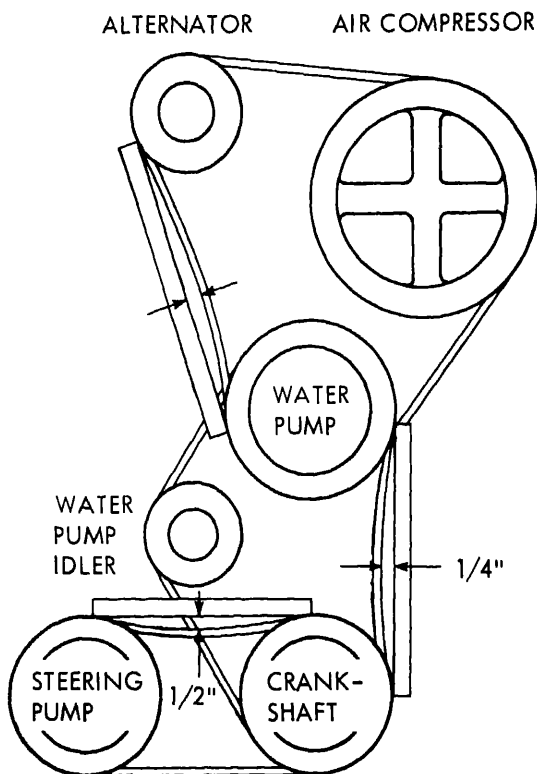
c. Belt Removal and Replacement. If any belts are removed, they must be adjusted as shown



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Figure 4-23. Water pump and idler, removal and replacement.

figure 4-24. Note that it is necessary to remove the power steering pump belts and compressor belts before the water pump can be removed. Refer to paragraphs 4-69 and 4-70 for removal of belts when they are removed.



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Figure 4-24. Belt tension adjustment.

Section XIV. MAINTENANCE OF CARRIER ELECTRICAL SYSTEM

4-48. General

The carrier has a 24-volt, negative ground electrical system. Refer to figure 3-4 for the schematic diagram. The system consists of two 12-volt batteries, the starting motor, an alternator with an internal voltage regulator, and other components as shown in the schematic diagram.

WARNING

Always disconnect battery cables before working on electrical components.

4-49. Alternator

a. General. The alternator is the same as is used on the crane. Refer to paragraph 2-88.

b. Belt Adjustment. Refer to figure 4-24 and adjust the alternator belt tension. Note that the alternator belts also drive the air compressor and that the air compressor belt tension is being adjusted at the same time.

c. Alternator Removal and Replacement. Refer to figure 4-25 and loosen alternator drive belts by loosening adjusting lock screw. Remove all electrical leads to the alternator as shown. Tag all leads to show correct location. Support the alternator, remove the adjusting lock screw, and remove the alternator mounting bolts, nuts, and lock washers. Remove alternator. Refer to figure 4-25 and replace the alternator.

d. Alternator Testing. Alternator testing is identical to the procedure for the crane alternator. Refer to paragraph 2-88 and test the alternator.

4-50. Starting Assembly

a. General. The starting motor is designed for high torque, short use applications. It engages the engine flywheel ring gear and is used to crank the engine until it starts. When the engine starts, the starting motor automatically disengages.

CAUTION

Never crank the engine for more than 30 consecutive seconds with the starting motor. If this does not start the engine, wait for at least one minute before trying again.

b. Motor and Solenoid Test. Motor and solenoid testing is identical to the test described in paragraph 2-89.

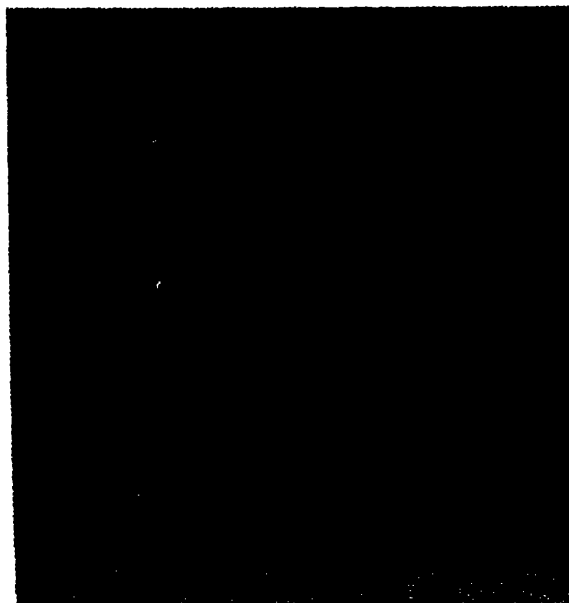


Figure 4-25. Alternator, removal and replacement.

c. Starting Motor Replacement. Refer to figure 4-26 and remove and replace the starting motor.

d. Starting Motor Solenoid Replacement. Replacement of the carrier starting motor solenoid is the same as replacement of the crane starting motor solenoid. Refer to figure 2-87 and replace the starting motor solenoid.

e. Reverse Polarity Relay. The carrier engine reverse polarity relay is mounted on the cab side panel. The methods of testing and replacing the relay are identical to the crane reverse polarity relay. Refer to paragraph 2-89 and test and replace the carrier reverse polarity relay.

4-51. Distributor

a. General. The distributor is mounted on the engine front cover and secured with a hold-down bolt and washer. The distributor contains a centrifugal advance feature, plus a governor, which consists of a spinner valve positioned by the distributor shaft. The spinner valve governor mechanism supplies air to a diaphragm unit attached to the carburetor throttle body, thus controlling engine speed. The centrifugal advance mechanism consists of two identical weights, which are opposed by spring force. The primary function of the distributor is to open and close the



Figure 4-26. Starting motor, removal and replacement.

circuit between the low voltage source and the ignition coil so that the primary coil winding obtains intermittent surges of current. These surges build up magnetic fields around the primary coil. When the surge stops as the points open, the collapse of the field induces a high voltage surge in the secondary winding, which contains many more turns than the primary. This surge is directed to the spark plug of the cylinder on top center firing stroke to ignite the fuel.

b. Removal

(1) Refer to figure 4-27 and disconnect the governor air and vacuum lines.

(2) Loosen the distributor cap spring clips and remove the cap from the distributor

(3) Scribe a mark on the rim of the distributor housing, directly in line with the distributor rotor tip. This line locates the distributor shaft in relation to the distributor housing. See figure 4-28.

(4) Refer to figure 4-27 and disconnect the coil primary lead at the distributor cap.

(5) Refer to figure 4-27, remove the hold-down bolt, washer, and clamp, and remove the distributor

c Installation and Timing (Crankshaft Position Known).

NOTE

The following instructions apply if the engine crankshaft has not been turned since the distributor was removed. If, for any reason the crankshaft has been turned, refer to step d below and proceed as instructed there.

(1) Place a new distributor mount in the counterbore in the engine

(2) Rotate the rotor so the tip aligns with the mark made on the housing at removal. Then turn the rotor

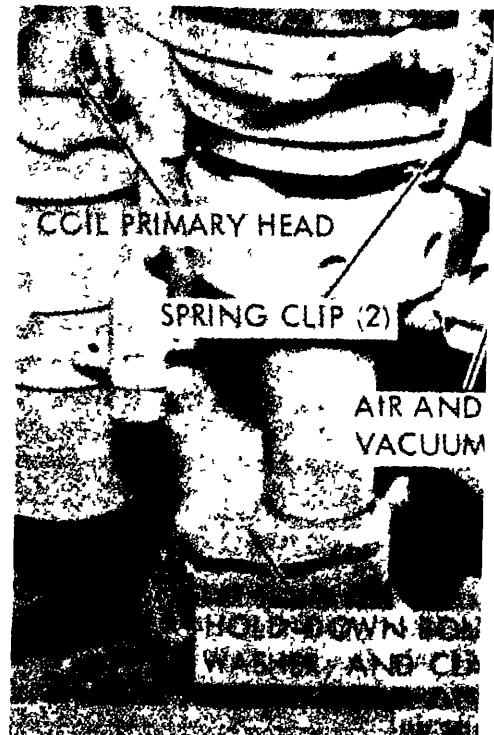


Figure 4-27. Distributor, removal and replacement.

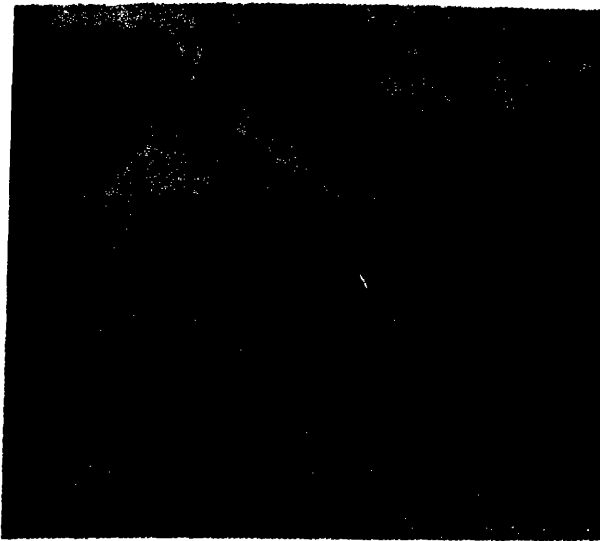


Figure 4-28. Marking rotor position.

turn or one cam lobe in the opposite direction of distributor rotation past the mark previously placed on the distributor housing to locate the rotor.

(3) Slide the distributor in position in the mounting hole on the engine in approximately the same location as when it was removed.

NOTE

It may be necessary to move the rotor slightly to start the gear into mesh with the camshaft gear, but the rotor should line up with the mark when the distributor is down in place.

(4) Install the distributor hold-down clamp, bolt and lockwasher.

NOTE

Do not tighten at this time.

(5) Connect the primary lead to the coil.

(6) Install the spark plug and high tension wires to the cap if removed, then install the cap to the distributor housing, making sure the tang aligns with the slot in the distributor cap.

NOTE

If the distributor cap is incorrectly positioned on the distributor housing, it will usually result in a broken rotor when attempting to start the engine.

(7) Start the engine and set the timing as instructed in *e* below.

d. Installation and Timing (Crankshaft Position Unknown).

(1) Remove No. 1 spark plug, then rotate the engine and hold thumb or forefinger on the spark plug hole until you feel pressure. Slowly continue cranking the engine until timing mark on the crankshaft pulley lines with the proper mark on the quadrant.

(2) Place a new distributor mounting gasket in the counterbore in the engine.

(3) While holding the distributor cap approximately the correct position, rotate the distributor rotor so that the rotor tip will point in the direction of the No. 1 terminal on the distributor cap indicated by a dab of paint on cap. Then turn the rotor 1/8 turn or one cam lobe in the opposite direction of distributor rotation past the No. 1 or No. 8 terminal position.

(4) Slide the distributor in position in mounting hole on the engine.

NOTE

It may be necessary to move the rotor slightly to start the gear into mesh with the camshaft gear, but the rotor should line up with the No. 1 terminal position when the distributor is down in place.

(5) Install the distributor hold-down clamp, bolt, and lockwasher.

NOTE

Do not tighten at this time.

(6) Connect the primary lead to the coil.

(7) Install the spark plug and high tension wires to the cap if removed, then install the cap to distributor housing, making sure the tang aligns with the slot in the distributor cap.

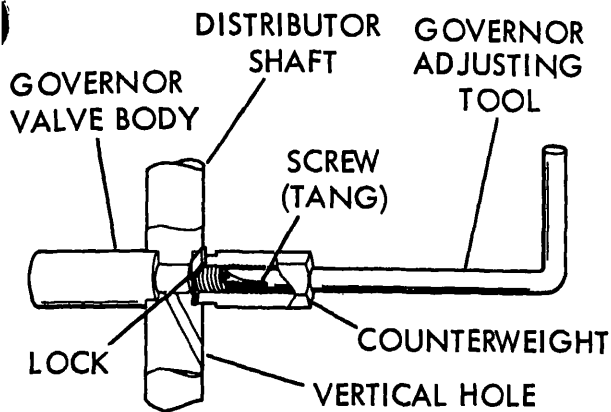
(8) Start the engine and set the timing described under *e* below.

e. Ignition Timing.

(1) Make certain that the distributor cap is properly located on the distributor housing that both spring clips are in place.

(2) The firing order is 1, 8, 7, 3, 6, 5, 2, and spark plug cables must be assembled to the distributor cap in this order in a counterclockwise rotation.

(3) Connect a stroboscopic timing light to the No. 1 spark plug. Some timing lights are intended to connect one lead to the spark terminal and the other to ground (parallel connection). Others require disconnecting the spark plug wire and connecting one of the timing light wires to the spark plug wire and the other wire to the spark plug terminal (series connection).



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Figure 4-30. Distributor point and condenser replacement and adjustment (sheet 3 of 3).

g. Cleaning Breaker Points. Clean breaker points as follows:

(1) Insert a piece of lintless tape between the contact surfaces and wet the tape at the contacts with a medicine dropper containing technical grade chloroform.

(2) Pull the tape out from between the contacts. The wet portion of the tape will remove all fingerprints, oil, or residue, and the dry end of the tape will remove all dust particles.

(3) Make certain that no lint fibers or threads are held between the contact surfaces.

NOTE

It is extremely important that the contact surfaces be thoroughly cleaned after they have been aligned and adjusted as the smallest amount of oil or perspiration on the surface will cause rapid oxidation when the distributor is placed into service.

h. Governor Adjustment. The distributor contains the governor adjustment. Adjust the governor only under the following circumstances.

(1) Adjust only if the entire speed range of the engine must be shifted up or down. Never adjust the governor because idle speed is too low unless governed top speed is also too low, or vice versa.

(2) Never attempt to adjust the governor unless the special adjusting tool, P/N SE20272-1, Mfg Code 81007, illustrated in figure 4-30 is available for making the adjustment. Adjust as follows:

CAUTION

Use of any device other than the tool illustrated in figure 4-30 will cause

damage to the governor feature of the distributor.

(a) Refer to figure 4-30 and remove governor band and gasket assembly.

(b) Turn engine over until adjusting screw hole appears in opening, as shown.

(c) Remove plug with 1/8 inch allen wrench.

(d) Insert slotted end of governor adjusting tool firmly in the hole, engaging adjusting tang. Turn tool handle clockwise to decrease speed and counterclockwise to increase speed. One full turn will change engine speed about 400 rpm.

(e) Reinstall plug with 1/8 inch Allen wrench.

(f) Reinstall governor band and gasket assembly.

4-52. Ignition Coil

a. General. The ignition coil is located on the right side of the engine, just below the distributor. It is mounted on a bracket which is attached to the cylinder head. See figure 4-31.

b. Removal. Remove the electrical leads from the coil, tagging each to identify for correct replacement. Remove the capscrews which secure the coil to the mounting bracket or cylinder head.

NOTE

It is very important that these engines with the correct coil at all times. If a resistor-type coil is installed without a resistor unit, it can result in coil burn-out and short spark plug life.

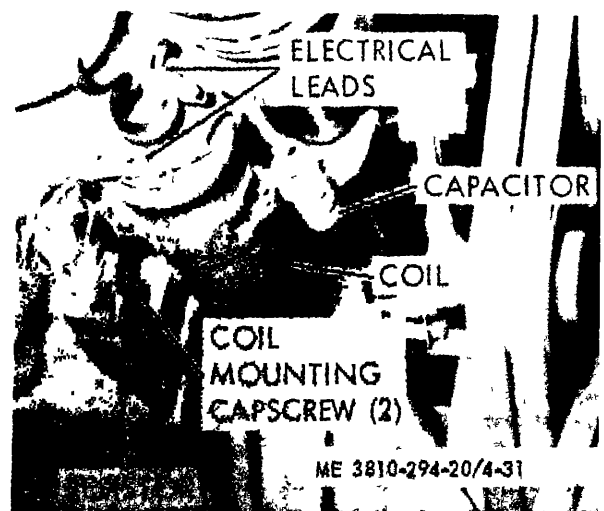


Figure 4-31. Ignition coil, removal and replacement.

NOTE

Follow the manufacturer's instruction on use of the timing light.

(4) See that timing is 7 degrees before top dead center firing stroke as checked against the ignition timing quadrant and ball, figure 4-29. The engine must be running at low idle speed, which is 400-to-500 rpm.

f. Point and Condenser Replacement. Refer to figure 4-30. Note that points and condensers can be replaced before reinstalling distributor.

(1) Remove distributor cap.

(2) Remove rotor as shown in figure 4-30 and remove dust cover.

(3) Refer to figure 4-30 and remove point lock screw and adjusting screw. Remove points.

(4) Remove condenser by removing attaching screw.

(5) Install new condenser and points and adjust breaker points as follows:

(a) Loosen two screws which hold contact bracket to the upper plate. Screws should be loosened only enough to permit the bracket to move when a small screwdriver is inserted between the plate-bracket notches, as shown in figure 4-30.

(b) Rotate the cam (using starter motor) until the rubbing block is on the highest point of the cam lobe.

(c) Insert screwdriver as shown in figure 4-30 (between mating notches in upper plate and contact bracket) and turn the screwdriver

until point gap is 0.017 inch, as measured with round feeler gage.

(d) Tighten screws loosened above and recheck gap. Readjust if necessary. Recheck again after first 100 hours.

(6) Install rotor and distributor cap.

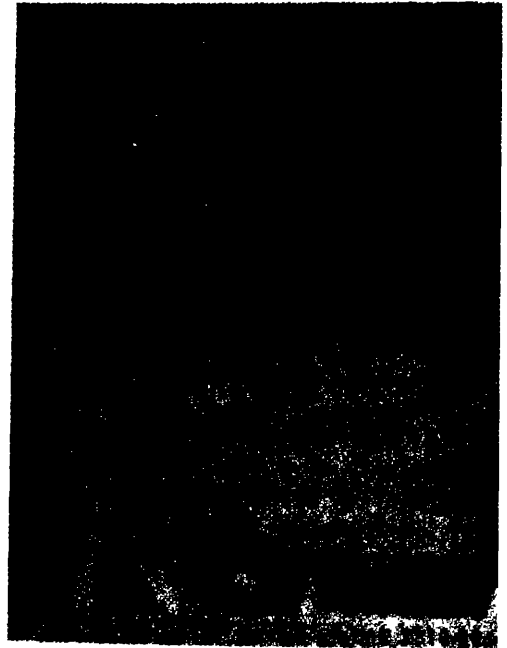
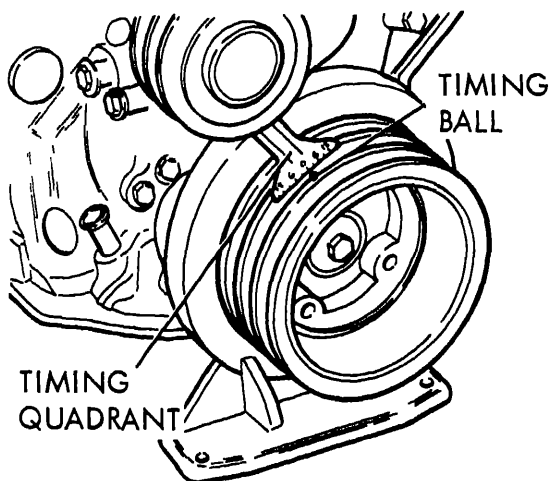
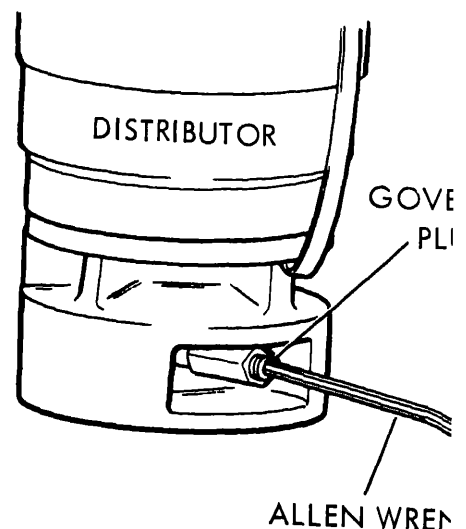


Figure 4-30. Distributor point and condenser replacement and adjustment (sheet 1 of 3)



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Figure 4-29. Ignition timing quadrant and ball.



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Figure 4-30. Distributor point and condenser replacement and adjustment (sheet 2 of 3)

ground electrodes. This will remove oxidation formations from the electrode surfaces which impair the sparking characteristics of the spark plug and will allow more accurate gap gauging.

(6) Reset the spark plug gap by bending the ground (or side) electrode towards the center electrode. Do not attempt to bend the center electrode, as insulator tip fracture may result. Use a round wire feeler gage to measure the clearance between the electrodes, which should be from 0.028-to 0.033-inch.

d. Installation. Install spark plugs and metal gaskets and tighten plugs finger tight. Then tighten them to 28- to 30-foot pounds, using a torque wrench if available. If not available snug the plugs down firmly. Do not overtighten as you may ruin threads in bore.

4-54. Suppression Leads

a. Removal. Refer to figure 4-32 for a view of the suppression leads. These leads are from the distributor to the spark plugs and to the coil. The leads are removed by unscrewing them at the distributor and disconnecting at the individual spark plugs.

b. Test. Connect ends of the suppression leads to test leads of an ohmmeter. The ohmmeter should read about 2000 ohms resistance per inch.

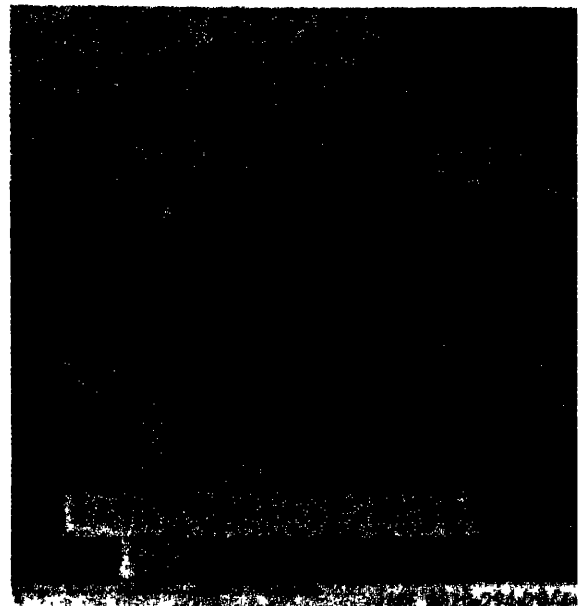


Figure 4-32. Suppression leads, removal and replacement.

Section XV. MAINTENANCE OF MANIFOLDS

4-55. General

The intake manifold is a one-piece casting and supplies both cylinder heads. Each head has a separate exhaust manifold with its own outlets.

4-56. Intake and Exhaust Manifolds

a. Removal.

(1) Refer to paragraph 4-60f and remove the crankcase breather lines.

(2) Refer to paragraph 4-40 and disconnect the throttle cable, the choke cable, and the two lines from the distributor to the carburetor at the carburetor. Disconnect the fuel inlet line and the air inlet line at the carburetor. Remove the four nuts and washers (fig. 4-18) which secure the carburetor to the intake manifold and remove the carburetor.

(3) Refer to figure 4-33, remove the intake manifold mounting capscrews and lockwashers and remove the intake manifold.

(4) Remove the eight capscrews (two per cylinder head) which secure each exhaust manifold to the cylinder head and remove the exhaust manifolds.

b. Inspection and Repair.

(1) Clean the manifolds thoroughly and inspect for cracks or leaks. If cracked or broken weld or replace.

(2) Place the exhaust manifolds on a surface plate and check for warpage. If warped true up on a surface grinder but replace if warpage is extreme.

(3) Warpage of the intake manifold will require replacement as any attempt to resurface the intake manifold will create misalignment of the ports to the cylinder heads.

c. Installation.

(1) Use all new gaskets when installing manifolds.

(2) Refer to figure 4-33 and install exhaust manifolds on cylinder heads, using two new capscrews per cylinder head. Install all bolts loosely, then tighten evenly to 20-to 25-foot pound torque.

(3) Refer to figure 4-33 and install the intake manifold.

(4) Refer to figure 4-18 and install the carburetor. Tighten carburetor mounting nuts 20-to 24-foot pounds.

c. *Test.* Refer to paragraph 2-91 for coil test procedures. No repairs are possible. Replace a faulty coil.

d. *Installation.* Refer to figure 4-81 and install the ignition coil.

4-53. Spark Plugs

a. *Removal.*

(1) Detach the ignition wires from each spark plug.

(2) Using the proper size deep socket wrench, loosen each spark plug two complete turns only. All spark plugs loosen in a counter-clockwise direction.

(3) The action of loosening each spark plug two turns will also loosen any accumulation of dirt which may be embedded around the base of the spark plug. Use a blast of compressed air to remove this debris and prevent its falling into the cylinder combustion chamber when the spark plug is removed.

(4) Remove all spark plugs, being careful not to lose the metal gaskets beneath each plug.

b. *Test.* Inspect spark plugs for obvious cracks, broken or severely worn points, pitting, discoloration, or accumulations of foreign material. Discard any spark plug not in good apparent condition. If available, install the plugs in a spark plug tester and check for adequate performance.

NOTE

Inspection, cleaning, and adjusting of spark plugs is recommended at 125 hour intervals. The condition of a plug and the color of any deposits found (or type of deposit) can be used to analyze engine performance.

(1) Inspect the spark plug gaskets. If the gaskets are not flattened it is an indication that the spark plugs have not been properly tightened to prevent flow-by between the spark plug and cylinder head. This condition results in excessive burning of the electrodes and overheats the insulator tip which may cause pre-ignition.

(2) If the gaskets are flattened or compressed to the point where they have become distorted (out-of-round) or torn, it is an indication that the spark plugs have been tightened to the extent that damage may have been inflicted on the spark plug itself. Excessive torque often causes strains on the steel shell of the spark plug which results in cracked insulators, distortion of metal shell and gap settings, as well as blow-by between the component parts of the spark plug.

(3) If the gasket is properly compressed (approx. half of original thickness) and flat, clean, even surface, it is an indication that the spark plugs have been properly installed.

(4) Inspect the condition of the spark plug. The extent of service to which a spark plug has been subjected is generally best indicated by the degree of wear of the electrodes. Whether the spark plug has become worn away, the ground electrode has become so badly eroded that the sparking area that resetting of the gap is either difficult or impossible, the spark plug is not fit for further efficient engine service and should be cleaned.

c. *Cleaning and Adjusting.*

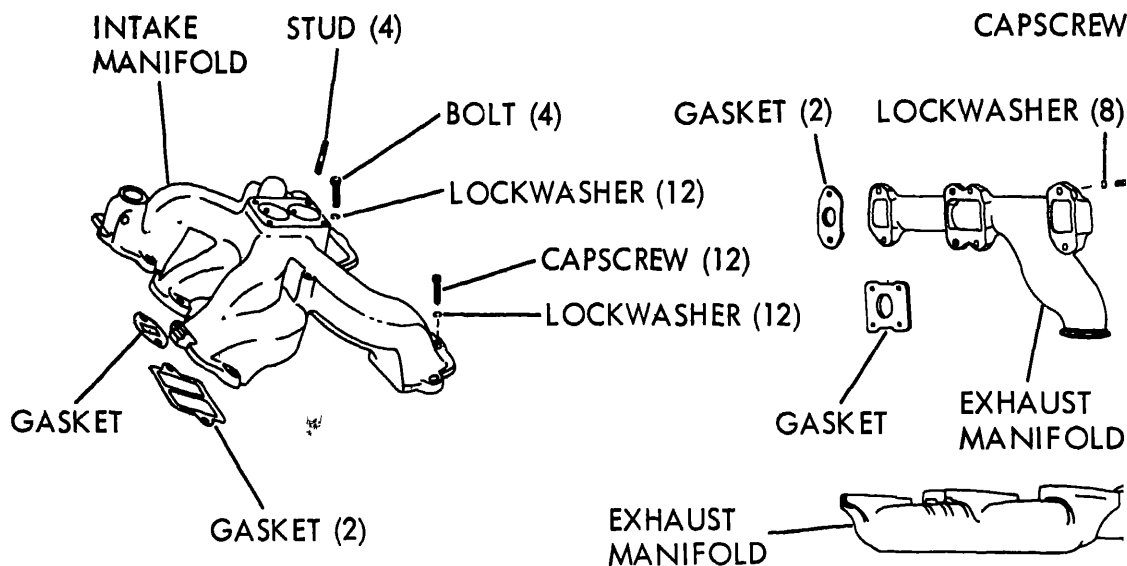
(1) Regardless of the condition of the spark plug gaskets, they should be removed from the spark plug before cleaning. If new replacement gaskets are available, the old ones should be discarded.

(2) Before abrasive cleaning, a spark plug which has oily deposits on the tip or the outside of the spark plug should be degreased by brushing with a suitable solvent which will dry quickly by wiping with a clean cloth or by air blast. Failure to do this with fouled spark plugs will result in packing the abrasive inside the firing end of the spark plug.

(3) Place the spark plug in the spark plug cleaner adapter of the correct size. Hold the spark plug at the terminal end and whirl the abrasive blast, "wobble" the spark plug in a circle. By this method the abrasive will be able to properly clean the tip and the electrodes. Three seconds should be sufficient to clean most spark plugs. However, the extent of cleaning time should be limited to that which is necessary to remove the deposits on the insulator nose. Excessive use of the abrasive blast will wear away the insulator, causing irreparable damage to the spark plug. Visual inspection will indicate when the spark plug has been properly cleaned. Do not use abrasive remaining inside the firing end of the spark plug removed by the "air blast" jet on the tip. Do not use picks or screwdriver to remove deposits inside the firing end of the spark plug.

(4) Remove loose abrasive or other material from the spark plug thread with a brass wire brush.

(5) Before setting the gap of a spark plug, pass a thin point file or wire over the sparking areas of the spark plug.



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Figure 4-33. Intake and exhaust manifold, removal and replacement.

(5) Refer to paragraph 4-31 and connect fuel, air, and distributor lines, and throttle and choke cable to the carburetor.

(6) Refer to paragraph 4-60f a lines removed.

Section XVI. MAINTENANCE OF CARRIER ENGINE OIL SYSTEM

4-57. General

The engine oil system consists of the supply of oil contained in the engine crankcase, and the oil pump, filters, tubing, temperature sensing device, the dipstick, and the openings in the crankcase through which oil is added or drained.

4-58. Engine Crankcase

a. Crankcase Inspection Remove the engine oil dipstick, figure 4-34, wipe it dry with a clean lint free cloth, reinsert it in the dipstick opening and withdraw it. If oil level is below the FULL mark, servicing is required. Inspect the crankcase oil pan to see that no leaks are apparent and that the pan is not damaged.

b Crankcase Service. Pour the necessary amount of lubricant of the type specified in the current LO into the engine crankcase to bring the oil level to the FULL mark on the dipstick. Always shut the engine down for a few minutes before checking oil level. This will allow oil in the engine to return to the crankcase. Refer to figure 4-35 and drain the lubricating oil from the crankcase at the intervals prescribed in the current LO.

NOTE

Change oil filter elements as shown in figure 4-59 each time crankcase oil is changed.

4-59. Full-Flow Oil Filter

a. General. The full-flow oil filter is to separate and remove injurious particles from the engine oil before they enter the engine. The spring loaded pressure relief valve in the filter base. This valve prevents pressure in the system in the event that the filter becomes clogged.

b. Service and Replacement. The filter can be removed for easiest servicing. To do this, refer to figure 4-36 and proceed as follows:

(1) Remove the square head bolt (15) in the oil filter body (3) and drain the filter completely.

(2) Remove the three capscrews (4) holding the filter assembly to the crankcase. The filter assembly can now be moved from the engine.

(3) Turn out the hold-down bolt (5) and remove the oil filter body (3). The spring (4) and element (5) are free to be removed. Discard the filter element.



STEP 1. CHECK OIL LEVEL WITH
DIPSTICK.
STEP 2. REMOVE OIL FILLER CAP
AND ADD OIL AS REQUIRED.
SEE THAT OIL REACHES FULL
MARK ON DIPSTICK.

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Figure 4-34. Checking and servicing engine oil pan.

(4) Clean all parts (except the filter element) and dry thoroughly with compressed air.

(5) Check the operation of the pressure relief valve in the filter base. Be sure the ball does not stick or bind.

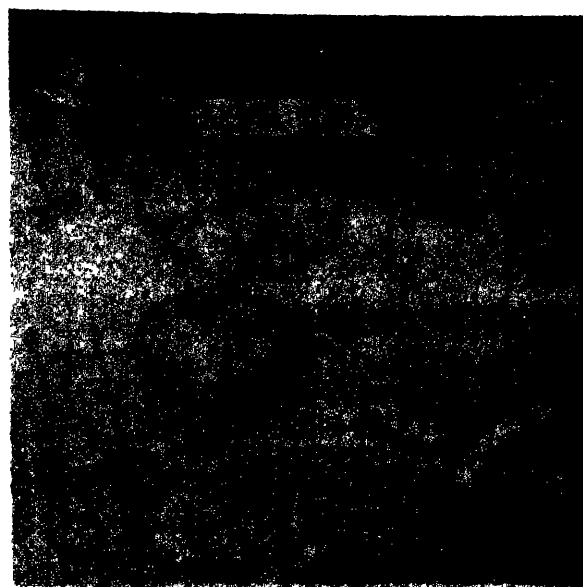
(6) Place a new body-to-base gasket (14) in the filter base. The gasket must lay flat to form a good seal.

(7) Place a new filter element (5) on the filter base. The larger opening in the element faces the filter base. Set the filter spring (4) on the filter element. Inspect the base edge of the filter body to be sure it is not bent or nicked.

(8) Place the washer (2) on the hold-down bolt (1) and slide it through the body (3), spring (4), and element (5). Tighten the bolt after being sure the filter body is properly centered in the base.

(9) Replace the pipe plug (15) in the filter body and tighten.

(10) Scrape and clean the gasket surface of the filter base and mating surface on the crankcase. Install new gasket and secure the filter as-



STEP 1. REMOVE DRAIN PLUG AND
DRAIN OIL INTO SUITABLE
CONTAINER. REPLACE
PLUG.

STEP 2. REFER TO FIGURE 4-34 AND
ADD NEW OIL.

STEP 3. CHECK LEVEL USING DIP-
STICK OR BY REMOVING LEVEL
PLUG SHOWN HERE.

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Figure 4-35. Draining engine oil pan.

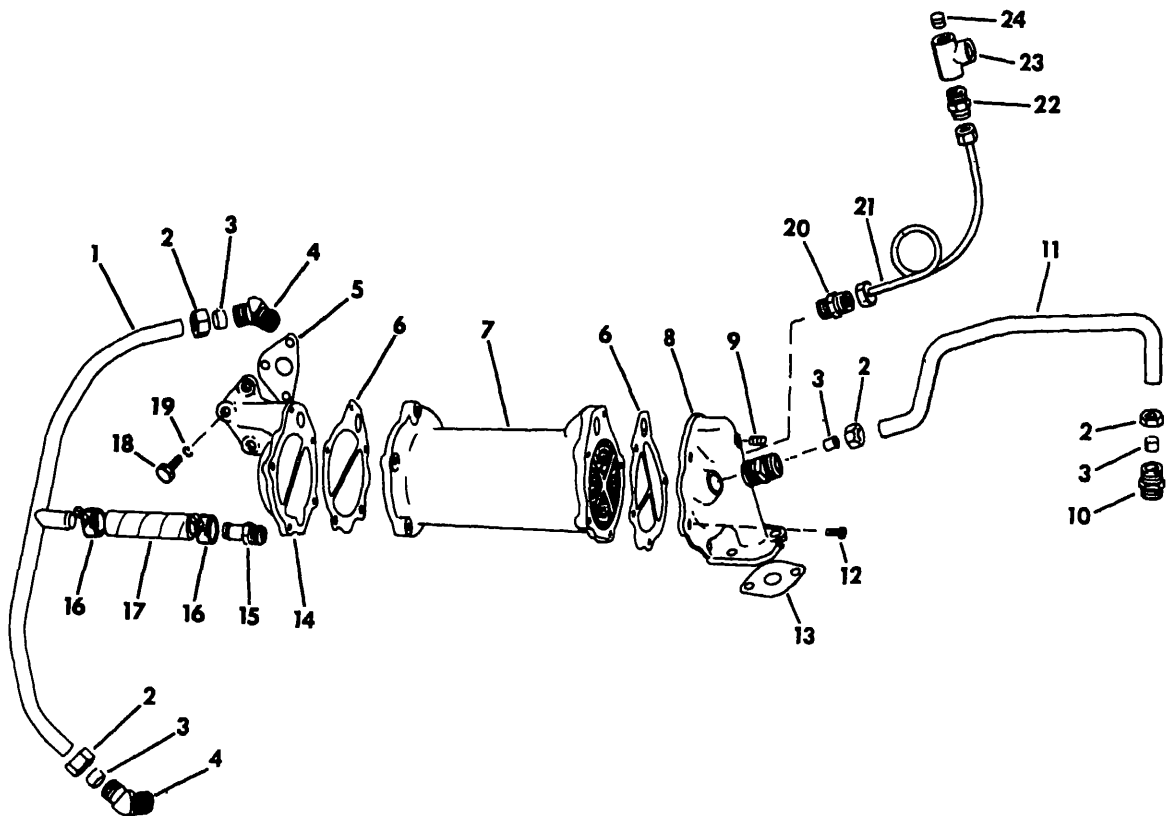
sembly to the crankcase with three capscrew. After warming up the engine, check the filter and connections for leaks.

4-60. Oil Cooler and External Lines

a. *General.* The oil cooler is a self-contained unit mounted on the "V" of the engine under the intake manifold. In extremely heavy duty service or very hot climate, the oil cooler is a safety feature to assure safe lubricating oil temperatures, maximum bearing life, and oil economy. In colder climates, the oil cooler works in reverse while the engine is warming up, by heating the crankcase oil quickly for proper engine lubrication and sludge control.

b. *Oil Cooler Removal.* Remove the oil cooler as follows:

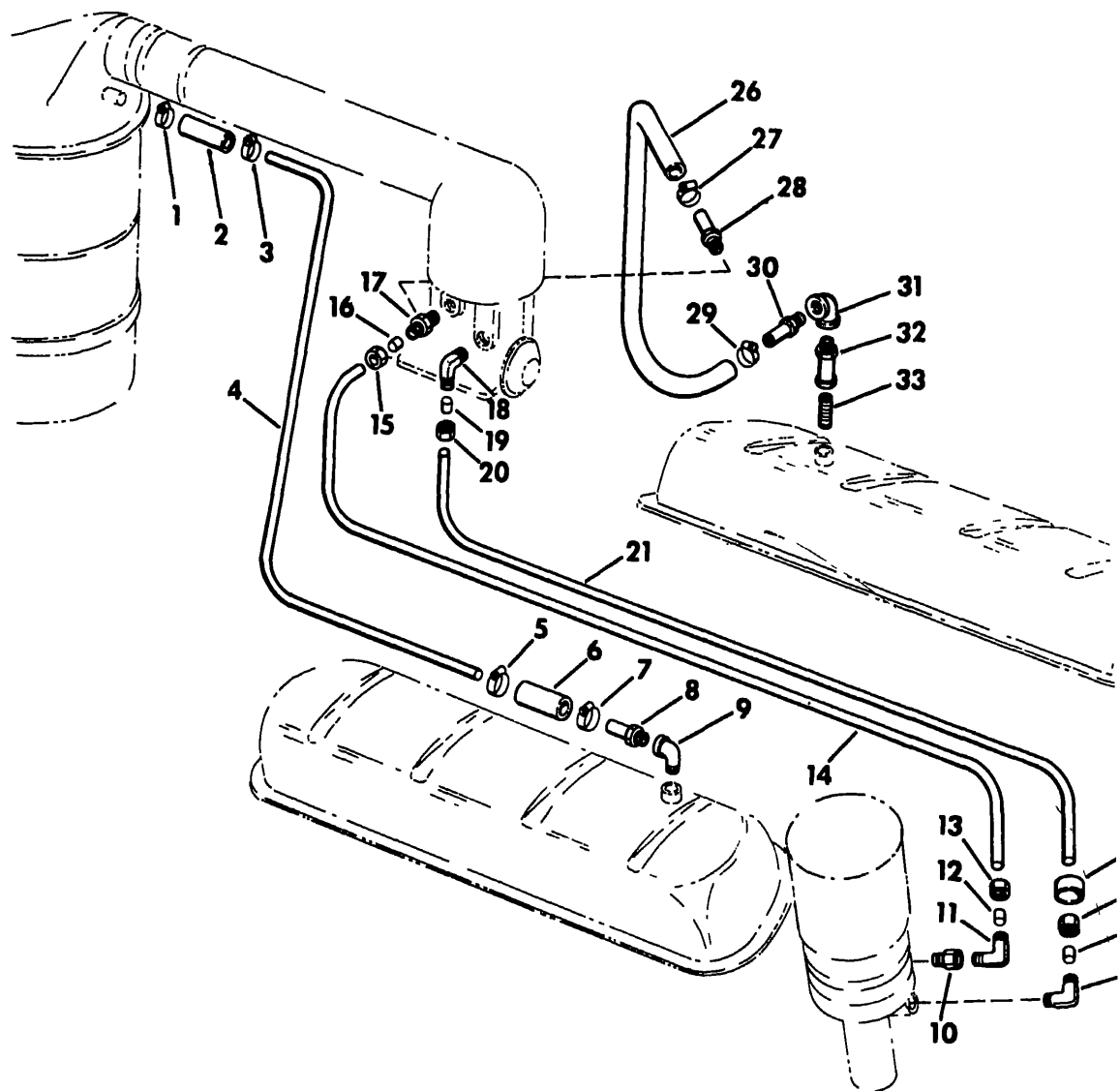
(1) Refer to paragraph 4-56 and remove intake manifolds.



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- | | | |
|------------------------|-----------------------|-----------------------|
| . Water crossover pipe | 9. Pipe plug | 17. Water outlet hose |
| . Nut (4) | 10. Connector | 18. Capscrew |
| . Sleeve (4) | 11. Cooler inlet pipe | 19. Lockwasher |
| . Elbow (2) | 12. Capscrew | 20. Fitting |
| . Gasket | 13. Gasket | 21. Pipe assembly |
| . Gasket | 14. Cover (rear) | 22. Fitting |
| . Oil cooler | 15. Nipple | 23. Tee |
| Cover (front) | 16. Clamp | 24. Pipe plug |

Figure 4-57. Oil cooler and external lines, service and replacement.



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- | | | |
|-----------------|-----------------|----------------|
| 1. Hose clamp | 12. Fitting | 23. Nut |
| 2. Hose | 13. Nut | 24. Fitting |
| 3. Hose clamp | 14. Tube | 25. Elbow |
| 4. Vent tube | 15. Nut | 26. Hose |
| 5. Hose clamp | 16. Fitting | 27. Hose clamp |
| 6. Hose | 17. Hex fitting | 28. Fitting |
| 7. Hose clamp | 18. Elbow | 29. Hose clamp |
| 8. Fitting | 19. Insert | 30. Fitting |
| 9. Elbow | 20. Nut | 31. Elbow |
| 10. Hex fitting | 21. Tube | 32. Fitting |
| 11. Elbow | 22. Nut cover | 33. Insert |

Figure 4-38. Crankcase breather and vent tubing, removal, service, and replacement.

Section XVII. MAINTENANCE OF ACCESSORY DRIVE MECHANISM

4-61. General

Customarily, only the flexible core of the speedometer or tachometer drive is replaced and a method of replacing it is described below. In the event that the entire cable must be replaced, a method of replacing it is also described. The tachometer drive cable is connected to the engine between the banks of cylinders, just forward of the air cleaner.

4-62. Speedometer and Tachometer Drive

a. Flexible Core Replacement. Loosen the

knurled nuts at each end of the flexible drive cable and remove the end. Withdraw the flexible core from within the sheath. Install a new flexible core in the sheath from the gage end and attach the ends of the flexible drive with the knurled nuts.

b. Drive Cable Installation. Install the new drive cable in the same clamps as the old cable and attach the ends of the cable with the knurled nuts.

Section XVIII. MAINTENANCE OF CARRIER ENGINE ASSEMBLY

4-63. General

Engine components and engine connected items which are the responsibility of organizational level maintenance are included in this section. These items include the engine clutch release mechanism, the two transmission shift mechanisms, and the engine valve covers.

4-64. Engine Service and Test

a. Service. Clean, inspect, and lubricate the carrier engine in accordance with instructions in LO 5-3810-294-12/4.

b. Compression Test. A compression check must be made with all spark plugs removed, the throttle wide open and the engine air cleaner removed. Compression should be uniform, not to exceed 10 psi between the highest and lowest reading per cylinders at normal cranking speed. Compression readings will deviate considerably from specifications due to crank speed, altitude, and ambient temperature. Therefore, the specifications listed in paragraph 3-7b(2) are to be used as a basic guide.

NOTE

The best indication of valve or ring leakage is to detect those cylinders not conforming to the allowable 10 psi variation

4-65. Valve Covers

a. General. Two valve covers are provided, one for each bank of the engine. There will be no need for normal periodic removal and replacement of these covers since valve tappets are replaced on this engine by non-adjustable hydraulic valve lifters.

b. Removal and Replacement. If required due to oil leaks, refer to figure 4-39 and remove and replace valve covers. Always replace the cover gaskets when covers are removed unless replacement gaskets are unavailable and the old gaskets are in good condition.

4-66. Rocker Arms

a. General. This engine is provided with hydraulic valve lifters instead of the more common tappet arrangement. The valve lifters consist primarily of a body, plunger, spring, and check valve. The purpose of the assembly is to keep the rocker arm in tight contact with the end of the valve (zero valve lash), thus eliminating the need for periodic valve tappet adjustments.

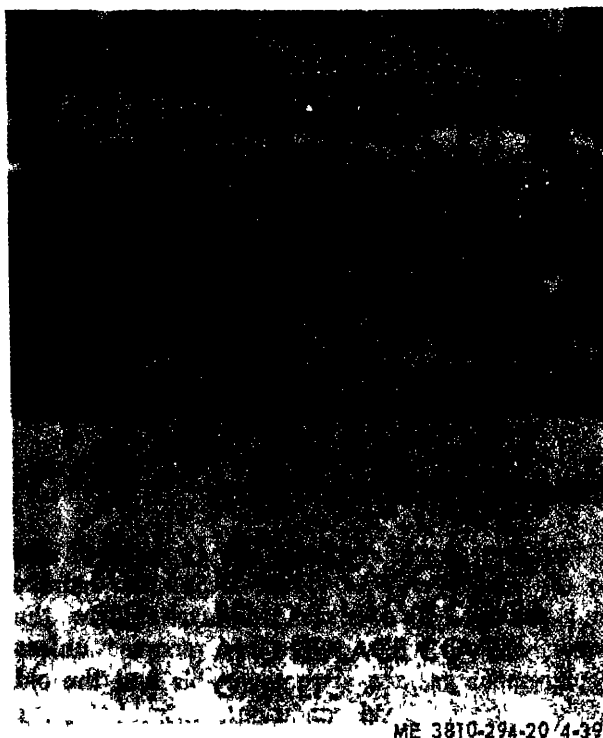
b. Adjustment. Because of the use of hydraulic valve lifters, there is no need to adjust valve tappets on this engine.

4-67. Engine Clutch Controls

a. General. The engine clutch can only be adjusted when it is removed and reinstalled. Therefore, this paragraph is restricted to clutch control adjustment and inspection.

b. Inspection. Inspect the clutch pedal free travel by depressing the clutch pedal by hand until resistance is felt. Release the pedal. Measure the distance the pedal travels. It should be between 3/4-and 1-inch. If not, it must be adjusted.

c. Adjustment. Refer to figure 4-40 and adjust the clutch.



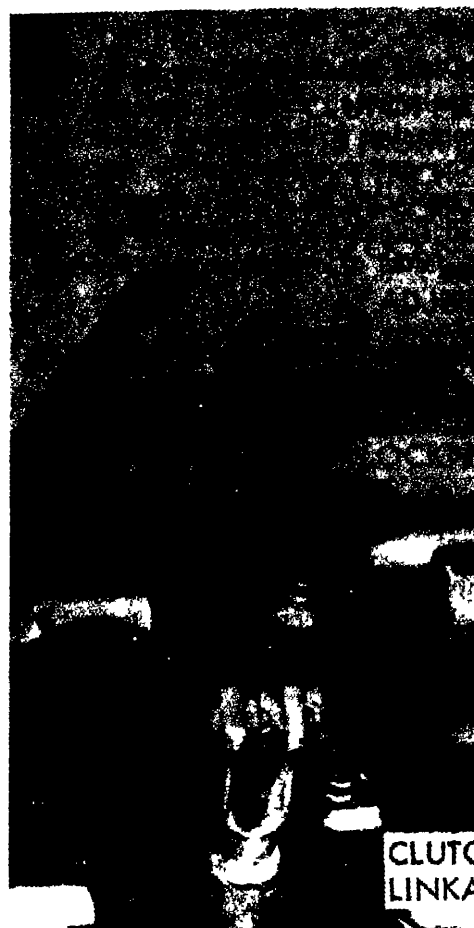
ME 3810-298-20/4-39

Figure 4-39. Valve covers, removal and replacement.

4-68. Axle, Transmission, and Transfer Case Controls

a. General. All controls described in this paragraph are mechanical linkages. All adjustments consist of restricting linkage movement within desired limits.

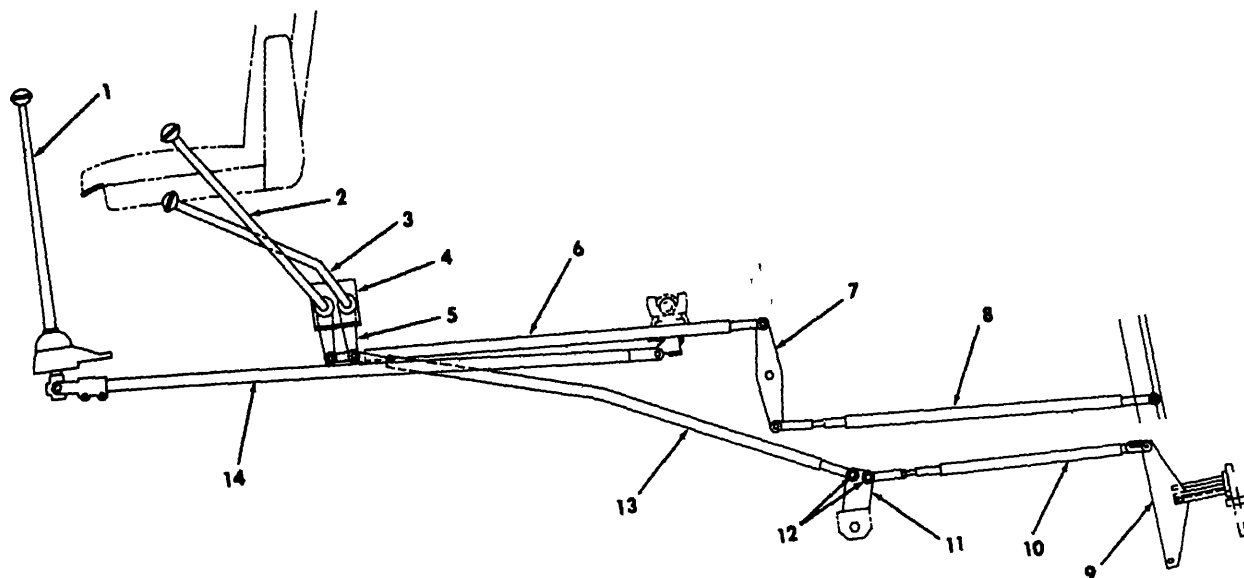
b Adjustment. Refer to figure 4-41 and adjust the length of rods (6, 8, or 10) if required to obtain proper shifting action. These adjust-



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Figure 4-40. Clutch control, adjustment.

ments need not ordinarily be re-should never be required unless pa moved.



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1. Lever, main transmission control
2. Lever, transfer case control
3. Lever, front axle control
4. Bracket, control lever
5. Lever
6. Rod, transfer case control
7. Lever, idler

8. Rod, transfer case control, rear
9. Lever, front axle drive
10. Rod, front axle control, rear
11. Idler, shifter rod
12. Pin, yoke
13. Rod, front axle control, rear
14. Rod, main transmission control

Figure 4-41. Axle, transmission, and transfer case controls adjustment.

Section XIX. MAINTENANCE OF STEERING ASSEMBLY

4-69. General

The power steering system (fig. 3-2) consists of a vane type hydraulic steering pump, a fluid reservoir, the steering gear proper (which contains a hydraulic control valve and a power cylinder), and mechanical steering control linkages.

4-70. Power Steering Pump and Reservoir

a. *Removal.* Remove the power steering pump and the pump drive belts as follows:

- (1) Refer to figure 4-42, remove the cap nut and drain the fluid from the hydraulic reservoir into a suitable container.
- (2) Refer to figure 4-43 and loosen the four adjusting capscrews to relieve power steering pump belt tension. Lift the power steering belts off the pump sheave.
- (3) Disconnect pump inlet and discharge lines.

(4) Refer to figure 4-43, remove the adjusting capscrews, nuts, and lockwashers and remove the power steering pump as an assembly.

(5) Refer to figure 4-44 and remove and replace the power steering reservoir. Note that the cover includes a dipstick type level gauge. Add oil to FULL mark on dipstick when replacing reservoir.

b. *Pump Replacement.* Install the power steering pump as shown in figure 4-43.

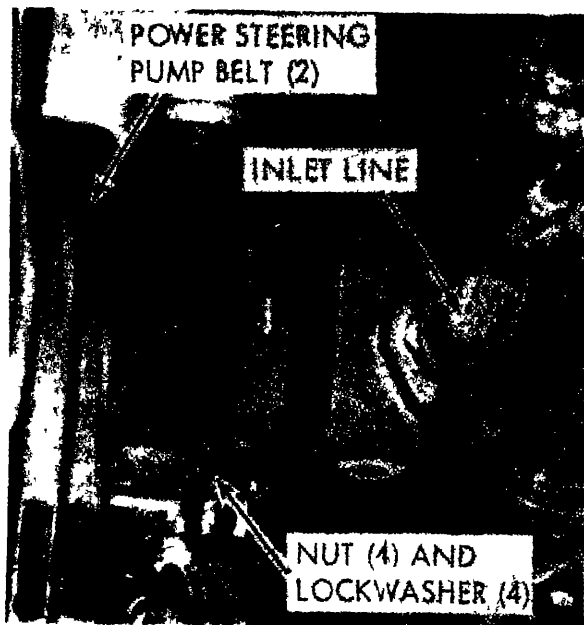
c. *Belt Tension Adjustment.* Refer to figure 4-24 and adjust belt tension which should be 1/2 inch midspan deflection.

d. *Reservoir Replacement.* Refer to figure 4-44 and replace the reservoir as follows.

- (1) Refer to figure 4-42 and drain reservoir by removing cap nut.
- (2) Refer to figure 4-44 and remove and replace reservoir.



Figure 4-42. Draining steering fluid.



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Figure 4-43 Power steering pump and belt, removal, adjustment and installation.

NOTE

When filling reservoir, one man must pour fluid into the reservoir while another man installs the cap nut (fig. 4-42). In this way, the air trapped in the line will be reduced. This can be bled of remaining air by turning steering wheel back and forth a few times.

4-71. Hoses, Lines, and Fittings

Refer to figure 3-2 and remove or replace defective hydraulic steering system hoses, fittings. Be sure to prevent fluid from entering any brake or clutch, and clean up any fluid immediately.

4-72. Drag Link

a. Removal. Refer to figure 4-45 and remove the drag link.

b. Installation. Refer to figure 4-45 and install the drag link. When tightening the plug, tighten the plug until it is snug. Turn off until the slot lines up with the cotter pin. Connections at the arm end of the drag link are the same.

4-73. Tie Rod

a. Removal. Remove the tie rod as follows:

- (1) Block the tie rod so that it cannot turn.
- (2) Refer to figure 4-46 and remove the cotter pin, nut, and tie rod pin. Remove the tie rod.

b. Replacement. Refer to figure 4-46 and install the tie rod.

4-74. Steering Wheel and Steering Column Assembly

a. Steering Wheel. Replacement of the steering wheel is covered under the topic Steering Column Removal. Refer to paragraph 4-25 for removal or replace the steering wheel.

b. Steering Column. Refer to figure 4-47 for removal or replace the steering column.

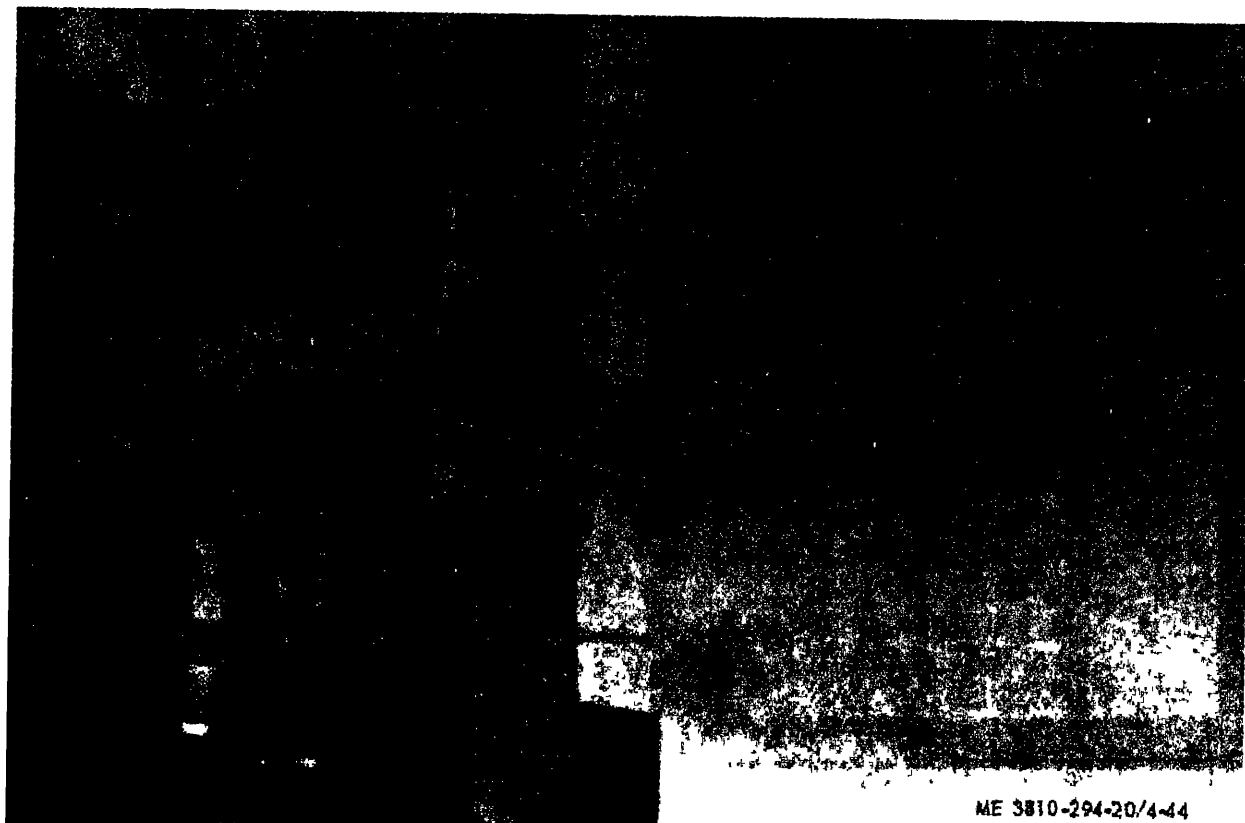


Figure 4-44. Power steering reservoir service and replacement.

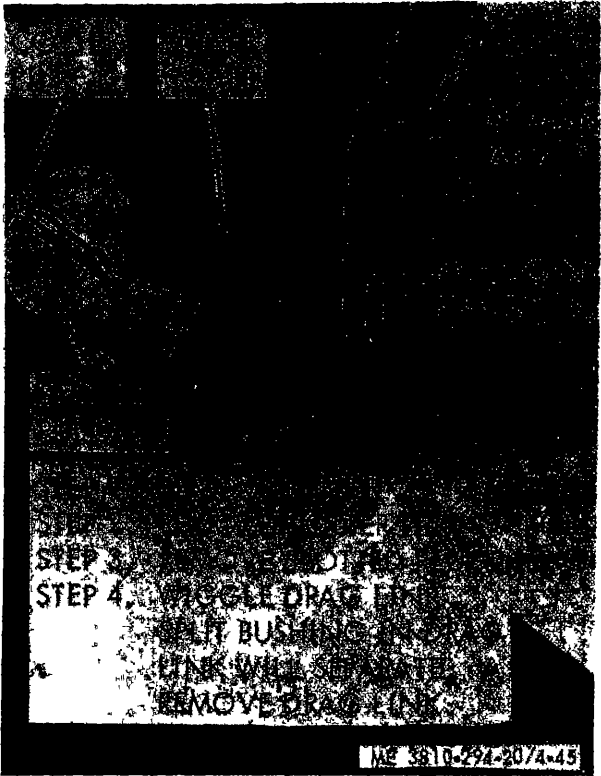
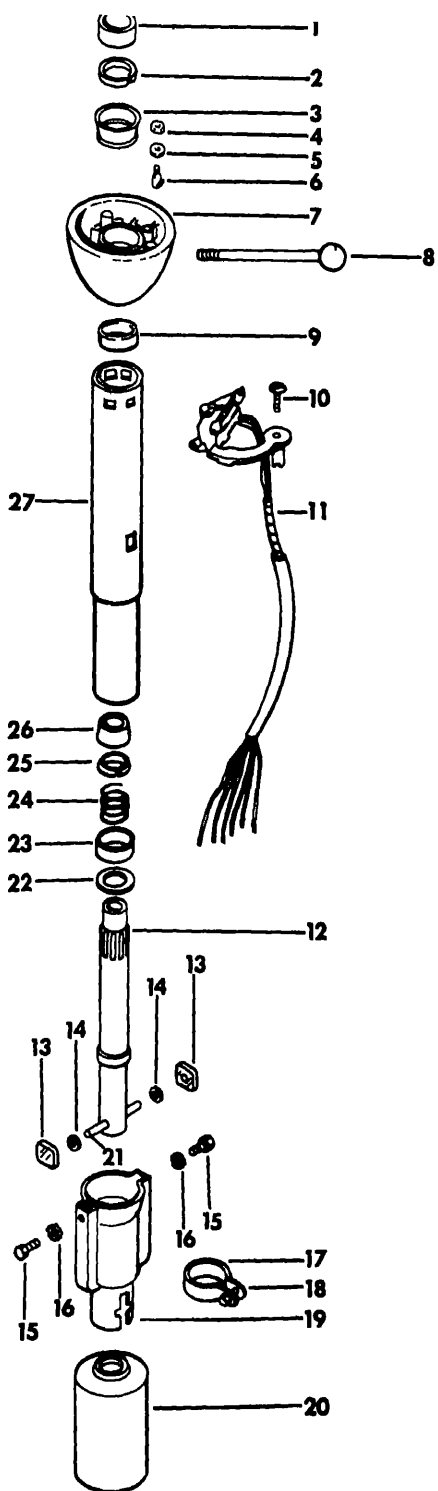


Figure 4-45. Drag link, removal and replacement.



Figure 4-46. Tie rod, removal and replacement.



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Figure 4-47. Steering column, exploded view.

Section XX. MAINTENANCE OF AIR BRAKE SYSTEM

4-75. General

Figure 4-48 is a piping diagram of the air brake system for the entire carrier. It also includes the windshield wiper motor and the low air pressure alarm. Items identified by both a number and a letter of the alphabet (for instance, 3C) indicate that a detailed view of that item is to be found on sheet 2 of figure 4-48.

4-76. Brake Chambers

a. Removal. Refer to figure 4-49 and remove the front wheel brake chamber. Refer to figure 4-50 and remove the rear wheel brake chamber.

b. Installation. Refer to figure 4-49 and install the front wheel brake chamber. Refer to figure 4-50 and install the rear wheel brake chamber.

4-77. Alcohol Evaporator

a. General. The purpose of the alcohol evaporator is to permit vaporized alcohol to be drawn into the air brake piping. This vapor prevents any possibility of loss of braking action due to freezing of water vapor in the system components. The device consists of a casting which forms a support for the reservoir, as shown in figure 4-51. Ordinary methyl alcohol is used in the system.

b. Removal. Disconnect the lines to the evaporator and remove the nuts and lockwashers which secure the evaporator cap. Unscrew the cap from the reservoir to disassembly.

c. Repair. To determine if the evaporator is operating properly, start the carrier engine and check to see if air bubbles pass through the alcohol in the reservoir. If bubbles are seen passing through the reservoir, the evaporator is operating properly. If no bubbles are present, remove the alcohol evaporator as previously instructed in this paragraph. Then, repair the alcohol evaporator as follows:

(1) Remove the strainer in the evaporator cap and clean thoroughly, using a suitable solvent.

(2) Replace the filler cap gasket and the cap gasket.

(3) Check to see that both lines to the evaporator are tight at end where they are attached to the compressor intake manifold and the compressor governor.

d. Installation. Refer to figure 4-51 and install the alcohol evaporator. Be sure lines evaporator are secure and check to see if bubbles can be seen passing through the orator when the compressor is compressing. To do so, remove filler cap.

4-78. Air Reservoirs

a. General. The only reason for removing a reservoir normally will be to replace the reservoir from an outside source. Quarterly, it is recommended that the reservoirs be completely drained by removing the lowest connection and allowing all air, water, sediment and oil trapped in the tank to drain.

b. Removal. Refer to figure 4-52, disconnect all air lines, and remove the air reservoir. There are three air reservoirs used on this machine. The removal and replacement procedures are basically the same.

c. Installation. Refer to figure 4-52 and install an air reservoir.

4-79. Valves, Hoses, and Fittings

Refer to figure 4-48 and remove and replace defective valve, hose, or fitting.

4-80. Service Brakes and Shoes

a. General. The front and rear brakes are actuated two-shoe brakes.

b. Adjustment. Adjustment of all brakes is the same, regardless of which wheel is involved. Adjust service brakes as follows:

(1) Jack up the wheel at which the brake is to be adjusted so that it does not contact ground.

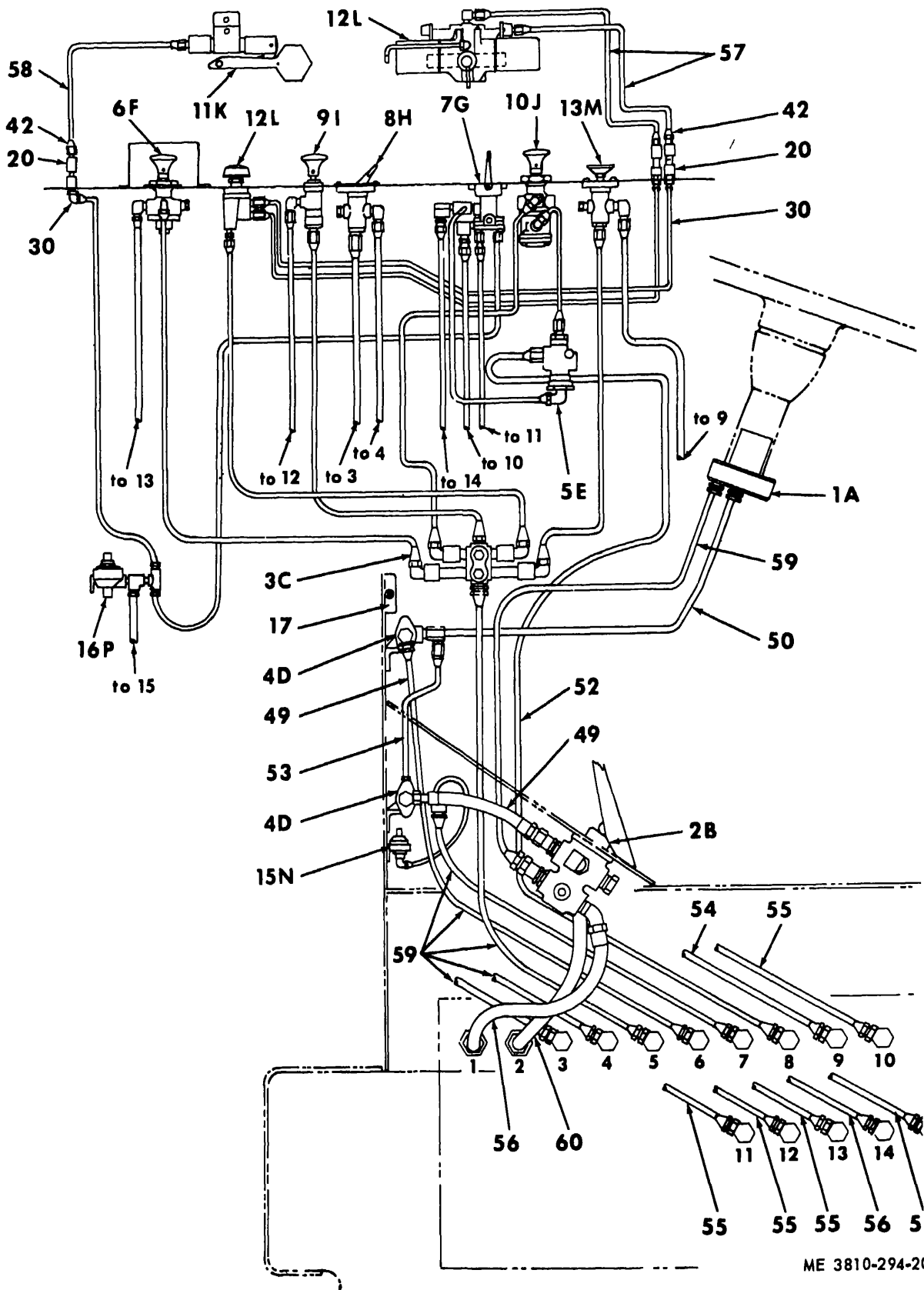
(2) Spin the wheel and keep it spinning through step (4) below.

(3) Refer to figure 4-49, push in the adjusting sleeve and turn the adjusting screw until the brake shoe just makes contact with the drum. This point will be apparent, since the point at which the wheel will slow down. Use an open end or socket wrench to turn the adjusting screw and hold the locking sleeve as far as it will go.

(4) Back off on the adjusting screw until the wheel just turns freely. Allow the adjusting sleeve to return to the upper (locking) position in order to maintain the adjustment just

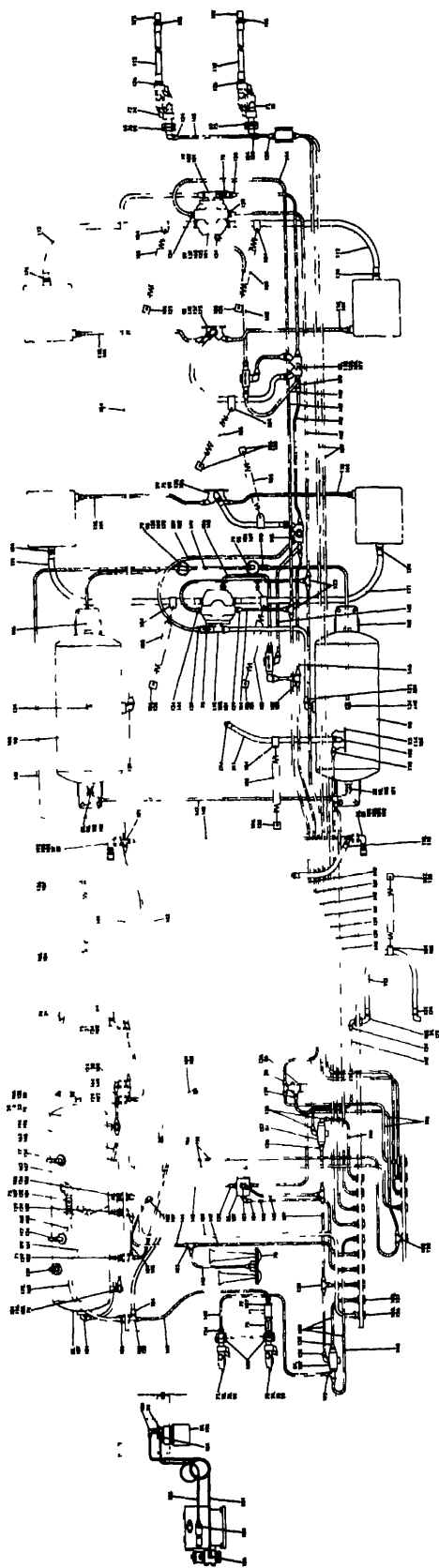
V-4 drain valve	70. Air horn	136. Roundhead machine screw with lockwasher and nut
P-3 control valve	71. Hose coupling (service)	137. Hex head capscrew, with nut and lockwasher
lag indicator	72. Coupling hose (emergency)	138. Hex head capscrew, with nut and lockwasher
Windshield wiper	73. Dummy coupling	139. Tube
Differential lockout valve	74. Dummy coupling	140. Tube
Muzzler	75. Service tag	141. Tube
Toplight switch	76. Emergency tag	142. Tube
Low pressure indicator switch	77. Cutout cock	143. Tube
Tube	78. Check valve	144. Tube
Standard pipe spacer	79. Drain valve	145. Tube
Standard pipe spacer	80. Safety valve	146. Tube
Quick disconnect	81. Double check valve	147. Tube
Coupling pipe	82. Air reservoir	148. Tube
Loose nipple	83. Quick disconnect	149. Tube
Reducing bushing	84. Alcohol evaporator	150. Tube
Rass pipe plug	85. Limit-and quick-release valve	151. Tube
Galvanized pipe plug	86. Pressure protection valve	152. Tube
Rommel	87. Hex pipe nipple	153. Tube
Rass pipe plug	88. Control valve	154. Tube
Adapter tee	89. Non-charging valve	155. Tube
Street tee	90. Air reservoir	156. Tube
Elbow	91. Tractor protection valve	157. Hex head capscrew, with nut and lockwasher
Connector	92. Manifold fitting	158. Tube
Tee	93. Frame tee	159. Tube
Tee	94. Check valve	160. Loom
0° Elbow	95. U-bolt	161. Loom
Connector	96. Tube clamp	162. Loom
0° Elbow	97. Tube clamp	163. Loom
5° Elbow	98. Hex pipe nipple	164. Loom
Male connector	99. Roundhead machine screw with nut and lockwasher	165. Hex head capscrew, with lockwasher and nut
Male connector	100. 90° Elbow	166. Street elbow
Male elbow	101. Reducing bushing	167. Connector
Male elbow	102. Anchor coupling	168. Hex head pipe plug
Male connector	103. Anchor coupling	169. Hex nut with lockwasher
Roundhead machine screw, with lockwasher and nut	104. Tube clamp	170. Female connector
Roundhead machine screw, with lockwasher and nut	105. Hose spring	171. Male run tee
Hex head capscrew, with lockwasher and nut	106. Spring clip	172. Male run tee
0° Elbow	107. Spring clip	173. Pipe coupling
Male connector	108. Clamping stud	174. Male connector
Male connector	109. Compressor discharge line	175. Male elbow
Hose assembly	110. Hose assembly	176. Male elbow
Hose assembly	111. Hose assembly	177. Male elbow
Hose assembly	112. Hose assembly	178. Tube
Hose assembly	113. Hose assembly	179. Tube
Hose assembly	114. Pipe plug	180. Pipe coupling
Hose assembly	115. Reducing bushing	181. Close pipe nipple
Hose assembly	116. Reducing bushing	182. Connector
Hose assembly	117. Reducing bushing	183. Tube union
Hose assembly	118. 45° Elbow	184. Connector
Hose assembly	119. Tee adapter	185. Male dust plug
Hose assembly	120. Tee	186. 90° Elbow
Hose assembly	121. 90° Elbow	187. Tube
Hose assembly	122. Union tee	188. Connector
Hose assembly	123. Tee	189. Tee adapter
Hose assembly	124. 90° Elbow	190. Male connector
Roundhead machine screw, with lockwasher	125. 90° Elbow	191. Hex head pipe plug
Roundhead machine screw, with lockwasher and nut	126. 90° Elbow	192. Street elbow
Valve cover	127. 90° Elbow	193. Tube
Male connector	128. Connector	194. Loom
Air pressure sending unit	129. Connector	195. Male connector
0° Male elbow	130. Connector	196. Hex nut with lockwasher
Tube	131. Street elbow	197. Street elbow
Roundhead machine screw with nut and lockwasher	132. Street elbow	
Reducing bushing	133. Reducing bushing	
	134. Tube connector	
	135. Roundhead machine screw with lockwasher and nut	

Figure 4-48 (1) — Continued.



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- | | | | |
|--------------------|-----------------------|-----------------------|--------------------|
| 1. Brake valve | 3. Air manifold | 5. SV-1 valve | 7. Three-way con |
| 2. Three-way valve | 4. Double check valve | 6. Double check valve | 8. Three-way valve |



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Figure 4-48. Air brake system piping diagram, valves, hoses, and fittings, removal and replacement (Sheet 3 of 3)

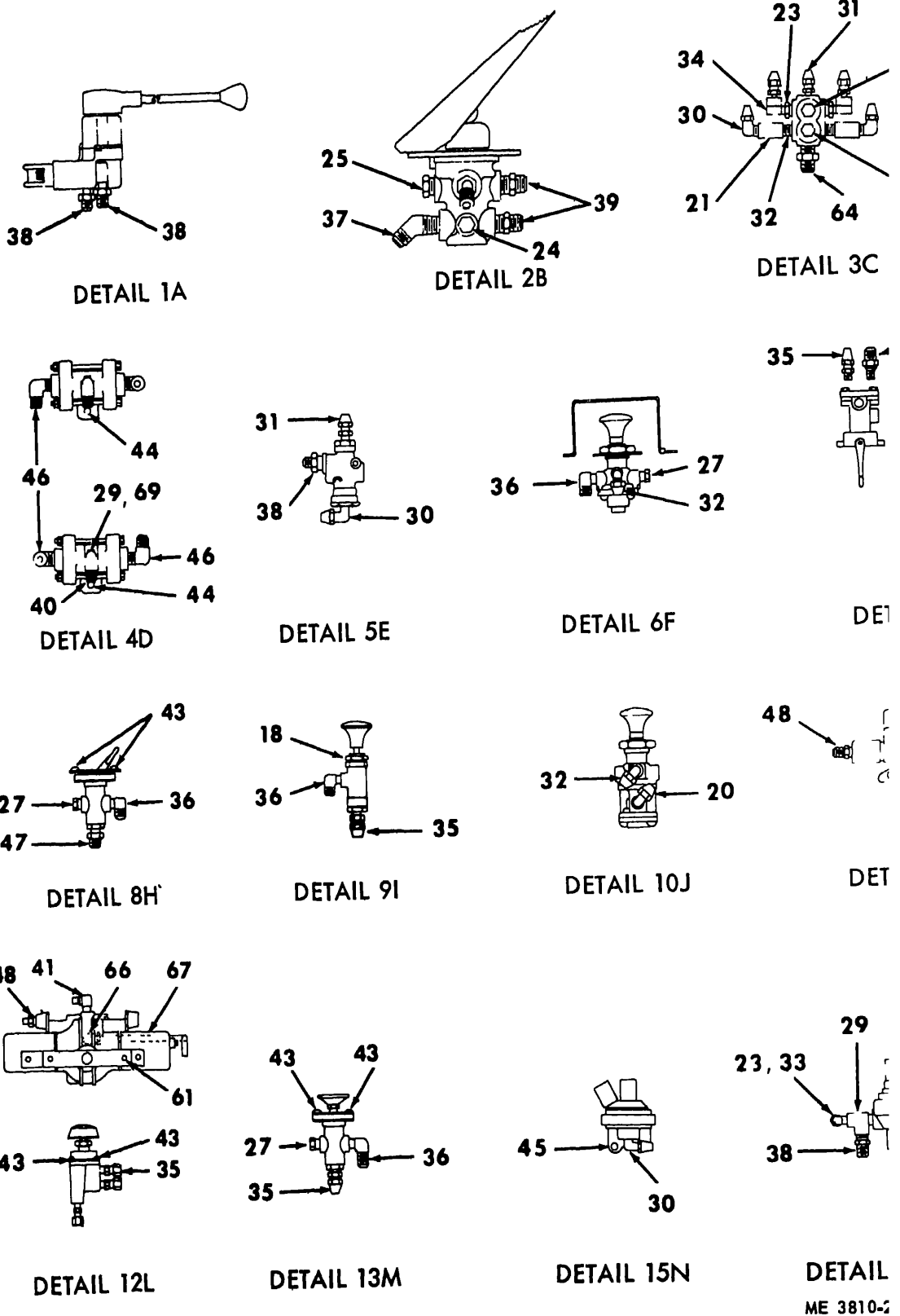


Figure 4-48. Air brake system piping diagram, valves, hoses, and fittings,

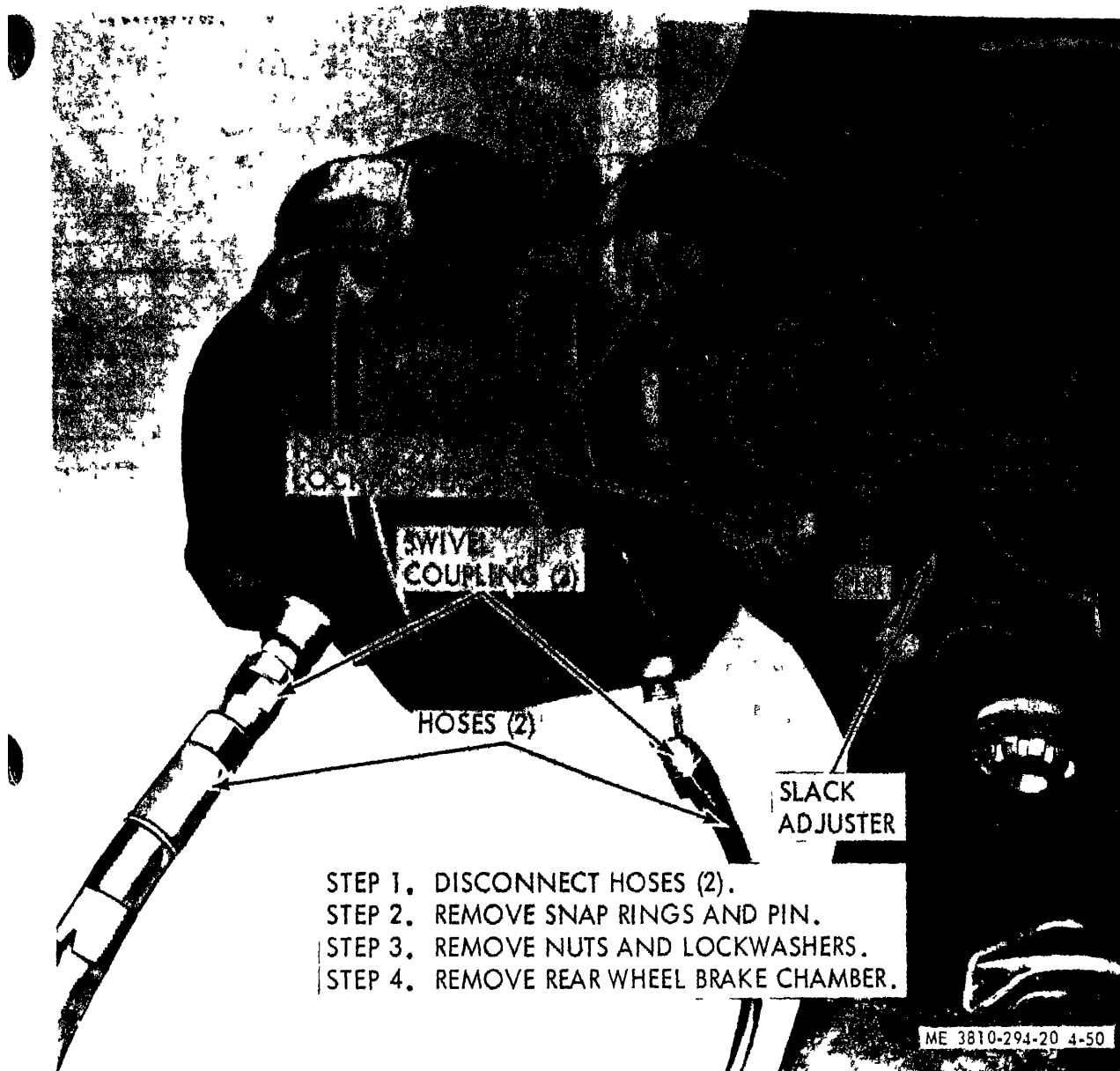
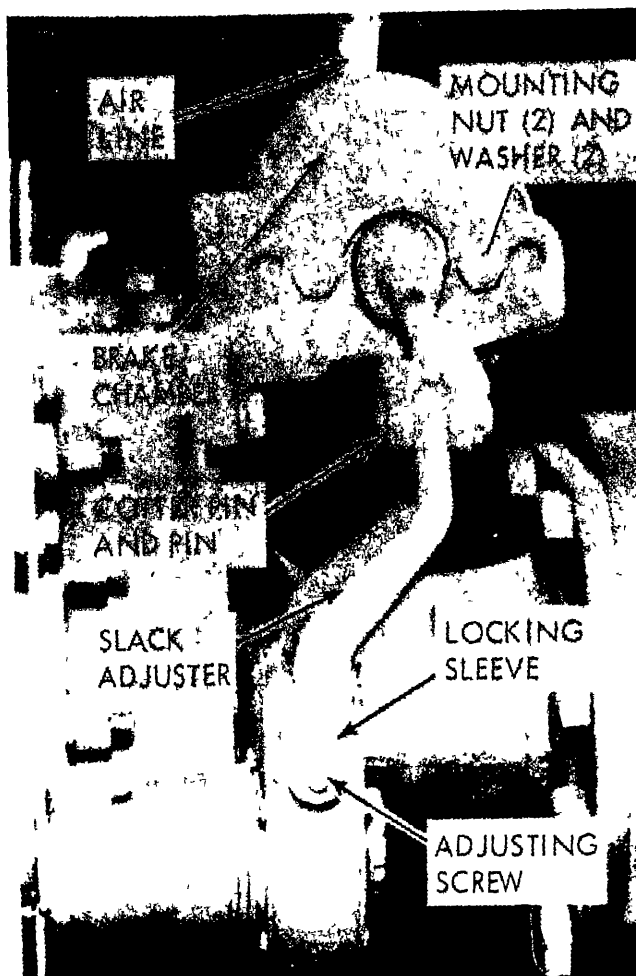


Figure 4-50. Rear wheel brake chamber, removal and replacement.

ON-OFF valve, both of which are used only at the front of the crane, in the "Emergency" circuit. Note that the ON-OFF valve is shown in the OFF position and should remain in that position, except when the crane is being towed.

b. *Removal and Replacement* To remove dummy couplings, disconnect the air lines at the swivel fittings, figure 4-54, unscrew mounting nuts on each side of the bracket, and remove the dummy couplings.



- STEP 1. RELEASE ALL AIR BRAKE PRESSURE.
- STEP 2. REMOVE SLACK ADJUSTER COTTER PIN AND PIN.
- STEP 3. UNSCREW AIR LINE CONNECTION TO REAR OF BRAKE CHAMBER AT SWIVEL CONNECTION.
- STEP 4. REMOVE MOUNTING NUT AND WASHERS.

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Figure 4-49. Front wheel brake chamber, removal and replacement.

c Brake Shoe Removal Remove brake shoes as follows:

(1) Jack up the axle of the wheel to be worked on and block the axle so that the wheel is supported off the ground. Be sure the machine is adequately blocked to prevent tipping.

(2) Refer to paragraph 4-85 and remove the wheel. Remove the brake drum nuts shown in the illustration and remove the brake drum.

(3) Refer to figure 4-53, remove the shoe return spring, remove the "C" washers from guide pins and anchor pins, and remove the brake shoes.

d Brake Shoe Installation

(1) Refer to figure 4-53 and install brake shoes.

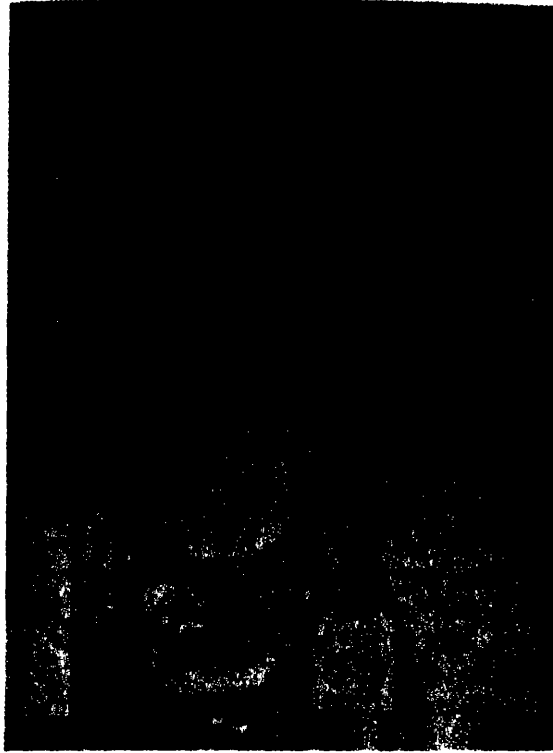
(2) Refer to paragraph 4-85 and install the wheel.

4-81. Dummy Couplings

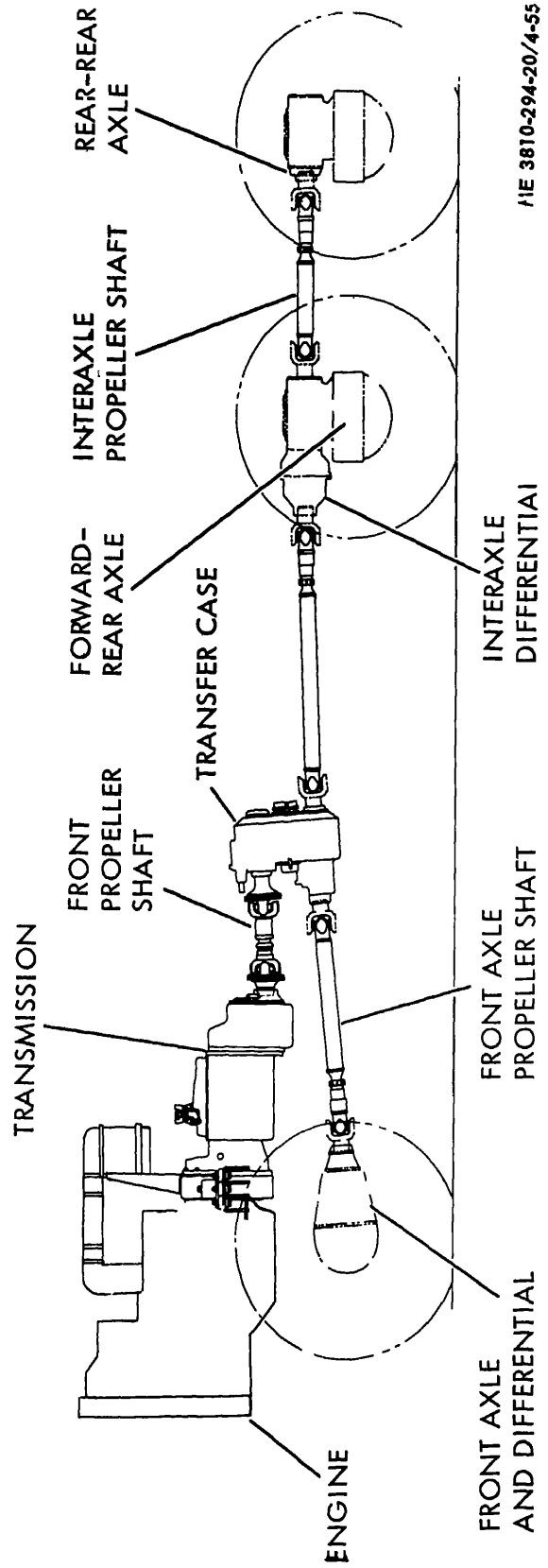
a General Trailer dummy couplings (54) are provided both at the front of and at the rear. In addition, couplings are provided between the rear of the carrier and the rear of the outrigger box. The dummy couplings are used to connect the crane vehicle similarly equipped. The crane can be towed by another vehicle when the other vehicle is attached to the rear pintle hook and dummy couplings are connected to the vehicle. The crane can be towed by another vehicle when the front pintle hook is only connected to the other vehicle and dummy couplings are connected to the tow vehicle. Figure 4-54 shows a check valve and :



FLANGE MOUNTING



LOCK STRAP MOUNTING



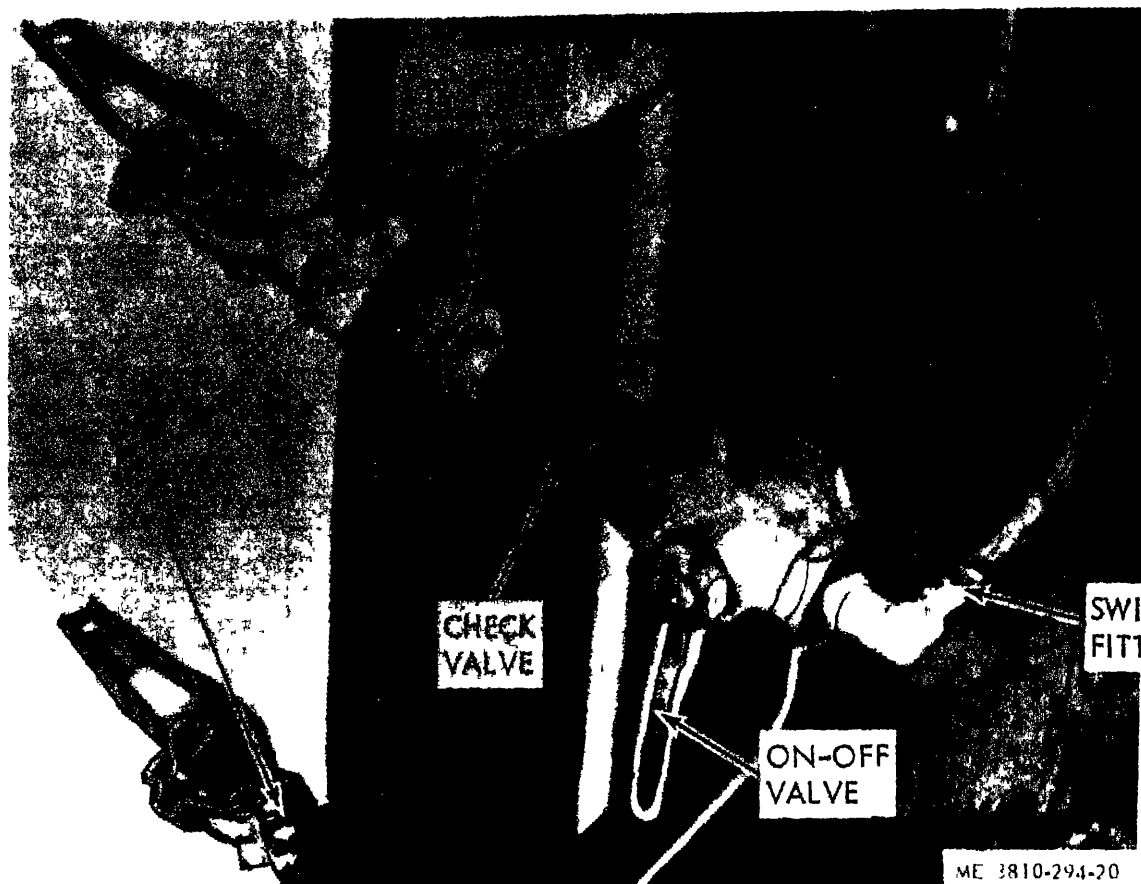


Figure 4-54. Dummy couplings, removal and replacement.

Section XXI. MAINTENANCE OF CARRIER DRIVE TRAIN

4-82. General

There are two differentials and four propeller shafts in the carrier drive train which require organizational maintenance as described in the following paragraphs

4-83. Propeller Shafts

a General Refer to figure 4-55 for location of the propeller shafts. All four propeller shafts are identical in construction, except for length and termination (flange or lock-strap mounting)

b Removal and Installation Refer to figure 4-55 and remove capscrews, lockwashers, and nuts to disconnect flange mountings. To disconnect lock strap connections, bend the lock straps away from the capscrews and remove capscrews, lock straps, and bearings. Install flange or lock strap mounted propeller shafts as shown in figure 4-55.

NOTE

After capscrews and lock straps have been moved, place brass drift to the center of and tap with hammer to loosen bearing caps. Move bearings and caps from yoke.

4-84. Front Axle Differential

a General The front axle differential (fig. 4-55) is a double-reduction unit which contains a spiral bevel pinion gear and helical gear to control drive torque to the front axle.

b Service Refer to the current issue 3810-294-12 for lubrication instruction.

4-85. Rear Axle Differential

a General. The forward-rear axle differential (fig. 4-55) is equipped with an internal differential which divides drive torque between the front and rear axles.

forward-rear and rear-rear axle assemblies. The differential incorporates a lockout device which converts the rear tandem assembly to a through drive type tandem. The differential lockout is

actuated by an air chamber and connected to the carrier cab.

b. *Service.* Refer to the current maintenance manual 5-3810-294-12 for lubrication instructions.

Section XXII. MAINTENANCE OF WHEELS, TRACK AND SUSPENSION

4-86. General

Figure 4-56 shows a typical left wheel. Note that the letter L is stamped on the ends of the wheel mounting studs. This indicates that the mounting studs have a left hand thread and that the nuts must be removed by turning in a clockwise direction. Wheel mounting studs marked with the letter R are normal right hand studs and the nuts are removed in the usual counter-clockwise direction.

4-87. Wheels, Tires, and Tubes

a. *Wheel Removal.* Always jack the axle from which the wheel is to be removed up and install a firm, solid blocking beneath the axle. Block the axle so that it can not fall when the wheel is removed. Then, refer to figure 4-56, remove the ten wheel mounting nuts and remove the wheel.

b. *Wheel Installation.* Install the wheel as shown in figure 4-56.

c. *Tire and Tube Removal.* Remove the wheel as instructed above. Then proceed as follows:

(1) Remove the valve core from the valve stem and be sure all air is allowed to escape from the tire.

WARNING

Air in the tire can cause serious injury to personnel attempting to remove tires from wheels.

(2) Using a suitable hammer, preferably at least 5-pounds in weight, strike the tire at points near the ring until the ring breaks loose from the tire. Start at the ring split and work around the ring.

(3) Insert a suitable tool in the slot in the ring and pound the ring in at a point 180 degrees from the ring split while prying out at the ring slot. Pry until the ring is loosened and projects above the wheel rim. Then pry the ring out of the rim, proceeding progressively around the ring from the slot.

(4) Using the hammer used to remove the ring, break the tire bead loose from the wheel then turn the wheel over and break the tire bead loose from the wheel at the other side. Remove the wheel from the tire.

(5) Remove the flap (a circular piece of flat rubber-like material which fits around the

inside of the inner tube) and then remove it from the tire.

(6) Inflate the tube, place it on the wheel to locate the leak by means of escaping air and patch the leak using either patches or tape.

d. *Tire and Tube Installation.* Install the tire and tube on the wheel as follows:

(1) Place the inner tube in the wheel and install the flap beneath the tube. Then inflate the tube to protect the tube from damage when the wheel and tube assembly is placed on the wheel.

(2) Place the wheel inside the tire opening in the wheel lined up with the valve stem. The wheel will be offset to the tire, with the valve stem closest to the stem. Insert the valve stem into the wheel and place the valve stem cap on the wheel to prevent the stem from coming out of the wheel.

(3) Center the wheel in the tire.

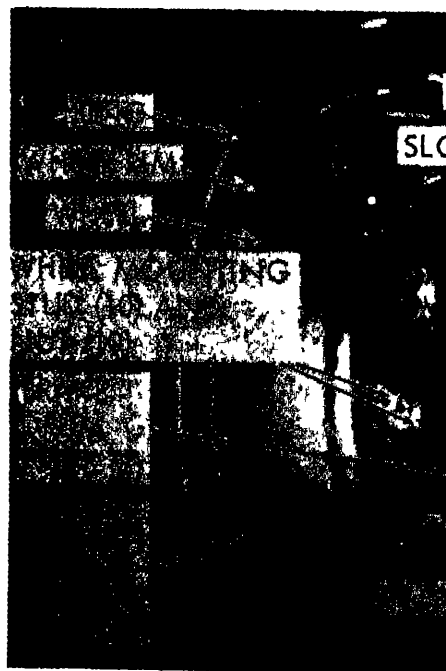


Figure 4-56. Tires and wheels, removal

(4) Using a suitable tool, starting at the ring split, force the ring into place around the edge of the wheel rim.

NOTE

It is very important that all rust, corrosion, and accumulated dirt be removed from the ring and its seating surface on the wheel rim.

(5) With the ring installed, turn the tire over so that the ring side is facing the ground. Using an air hose from the side opposite the ring, inflate the tire.

WARNING

Always inflate the tire from the side opposite the ring. If the ring is improperly installed, air pressure may cause it to fly off the wheel and serious injury to personnel may result.

(6) Install the wheel-tire on the vehicle.

4-88. Shock Absorbers

a. *Removal.* Refer to figure 4-57 and remove the shock absorbers.

b. *Installation.* Refer to figure 4-57 and install the shock absorbers.



Figure 4-57. Shock absorbers, removal and replacement.

Section XXIII. MAINTENANCE OF PNEUMATIC COMPRESSOR

4-89. General

The air compressor is lubricated by oil from the engine system and cooled by water from the engine system. Therefore, lubrication and cooling depend upon proper lubrication and cooling for the engine. Intake air is taken from the clean air side of the engine air cleaner.

4-90. Compressor Assembly

a. *Adjustment.* The governor should be adjusted so that it starts compressing air when pressure drops to 105 psi and stops compressing air when pressure reaches 125 psi. To adjust, proceed as follows:

(1) Start the engine and build up air pressure in the air brake system. Check the gage pressure at the cab air pressure gage at the time

the governor cuts off compression. Pressure should be 125 psi.

(2) With the engine still running, make series of brake applications to reduce reservoir air pressure. Note the pressure at which the governor starts the compressor. This pressure should be 105 psi. Before adjusting, it is recommended that the gage board pressure gage be checked with an accurate independent gage, if one is available.

(3) Remove the governor cover (fig. 4-58).

(4) Refer to figure 4-59 and loosen the adjusting screw locknut. With a screwdriver, turn the adjusting screw counterclockwise (viewed from above) to raise the pressure settings. Turn the screw clockwise to lower the pressure settings. Both the starting and stopping pressure settings will change by an approximately equal amount.

(5) Recheck the starting and stopping points of the compressor as described (1 and 2 above). Then tighten the adjusting screw locknut. Install the governor cover.

b. *Removal.* Remove the air compressor as follows:

(1) Refer to paragraph 4-49 and release alternator belt tension. Lift the belt off the compressor drive sheave.

(2) Refer to figure 4-58 and disconnect the two alcohol evaporator lines which go to the air compressor intake manifold and governor at the swivel fittings.

(3) Remove the compressor discharge air line by removing the attaching nuts and lockwashers.

(4) Remove the compressor intake air line by removing the attaching bolts and lockwashers.

(5) Refer to figure 4-58 and disconnect the oil line to the compressor.

(6) Refer to figure 4-58 and disconnect the water lines to the compressor mounting bolts and lockwashers and remove the air compressor



Figure 4-58. Air compressor, removal and replacement. (sheet 1 of 2)

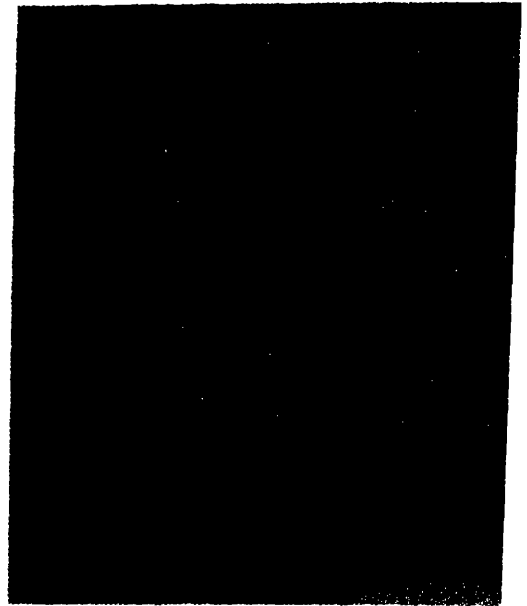


Figure 4-58. Air compressor, removal replacement. (sheet 2 of 2)

c. *Installation.* Install the air compressor as illustrated in figure 4-58. Replace all and check governor adjustment as described above before returning the machine to

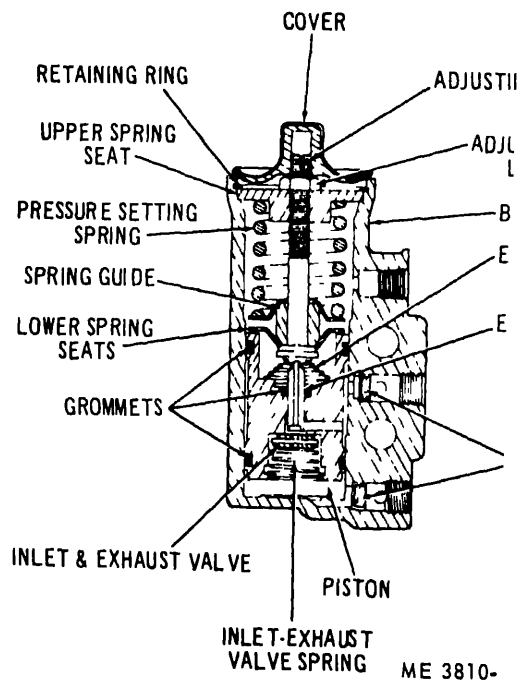


Figure 4-59. Air compressor governor adjustment.

Check all water, air, and oil lines to be sure there are no leaks. Refer to paragraph 4-49 and adjust the alternator belt tension since the alternator belt also drives the compressor.

4-91. Alcohol Evaporator Strainer

Refer to paragraph 4-77c for removal and placement of the alcohol evaporator strainer.

Section XXIV. MAINTENANCE OF FRAME COMPONENTS

4-92. Boom Rest

a. Removal. Refer to figure 4-60 and remove the boom rest.

b. Replacement. Position boom rest as shown in figure 4-60 and install lockwashers and capscrews.

4-93. Pintle Hook

a. General. The pintle hook (23, fig. 4-61) is mounted on the rear outrigger box.

b. Removal. Remove the cotter pin (11) and nut (12) and remove the pintle hook (23) from the rear outrigger box.

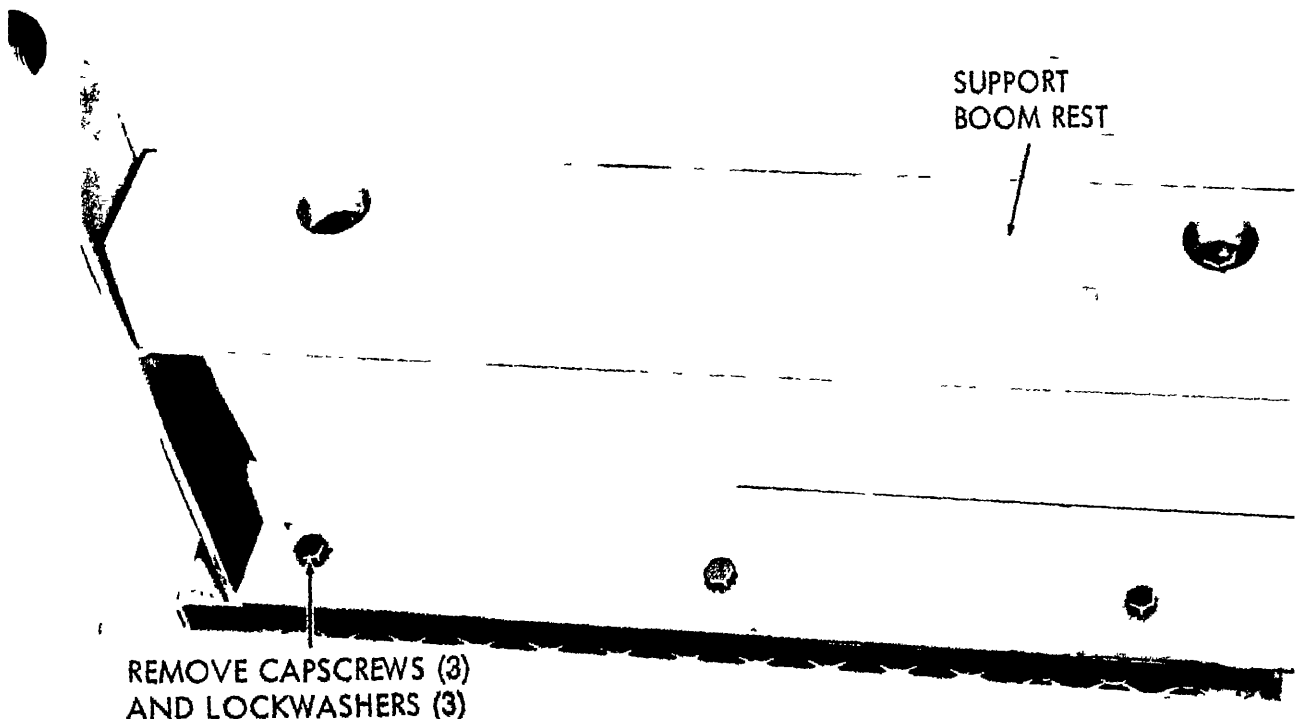
c. Repair. Replace the hinge pin and chain if broken or damaged.

d. Replacement. Install the pintle hook in rear outrigger and secure with nut (12) and cotter pin (11).

4-94. Outriggers

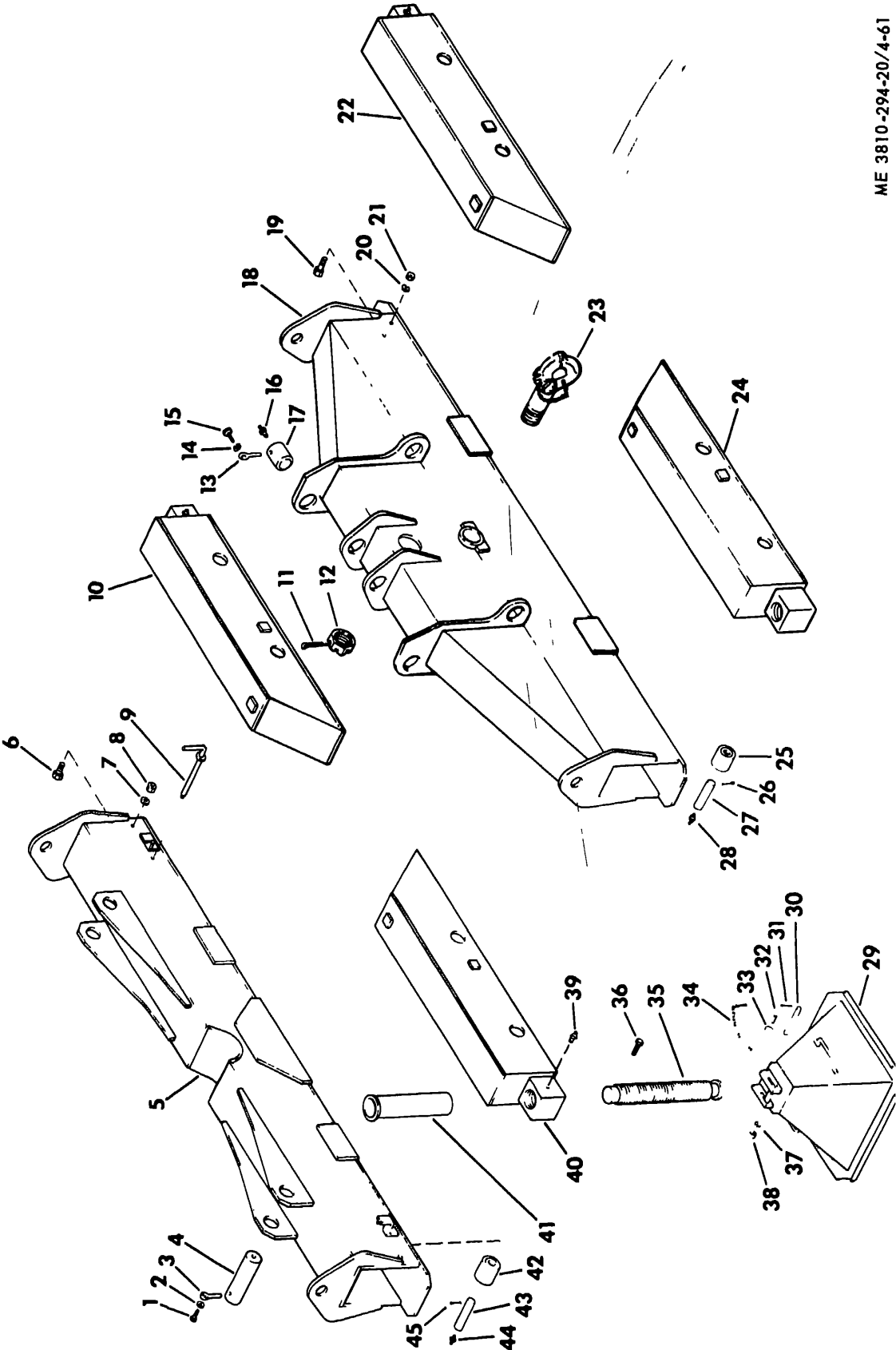
a. Replacement. Refer to figure 4-62 and move and replace the outriggers.

b. Repair. Refer to figure 4-61 and remove any rust or corrosion from the outrigger beam and boxes and paint in accordance with TM 213. Replace any damaged or bound outrigger beam roller or jack screws and damaged outrigger box pins, eye pins, or capscrews. Report broken or cracked welds to direct support maintenance.



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Figure 4-60. Boom rest installed.



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- | | | |
|------------------------|-------------------------|---------------------|
| 1. Capscrew | 25. Beam roller | 37. Lockwasher |
| 2. Lockwasher | 26. Cotter pin | 38. Nut |
| 3. Rod end | 27. Roller pin | 39. Grease fitting |
| 4. Outrigger box pin | 28. Grease fitting | 40. Outrigger beam |
| 5. Front outrigger box | 29. Outrigger float | 41. Jackscrew cover |
| 6. Capscrew | 30. Pin | 42. Beam roller |
| 7. Lockwasher | 31. Cotter pin | 43. Roller pin |
| 8. Jam nut | 32. Capscrew | 44. Grease fitting |
| 9. Beam lock pin | 33. Flat washer | 45. Cotter pin |
| 10. Outrigger beam | 34. Chain | |
| 11. Cotter pin | 35. Jackscrew outrigger | |
| 12. Nut | 36. Capscrew | |

Figure 4-61 — Continued

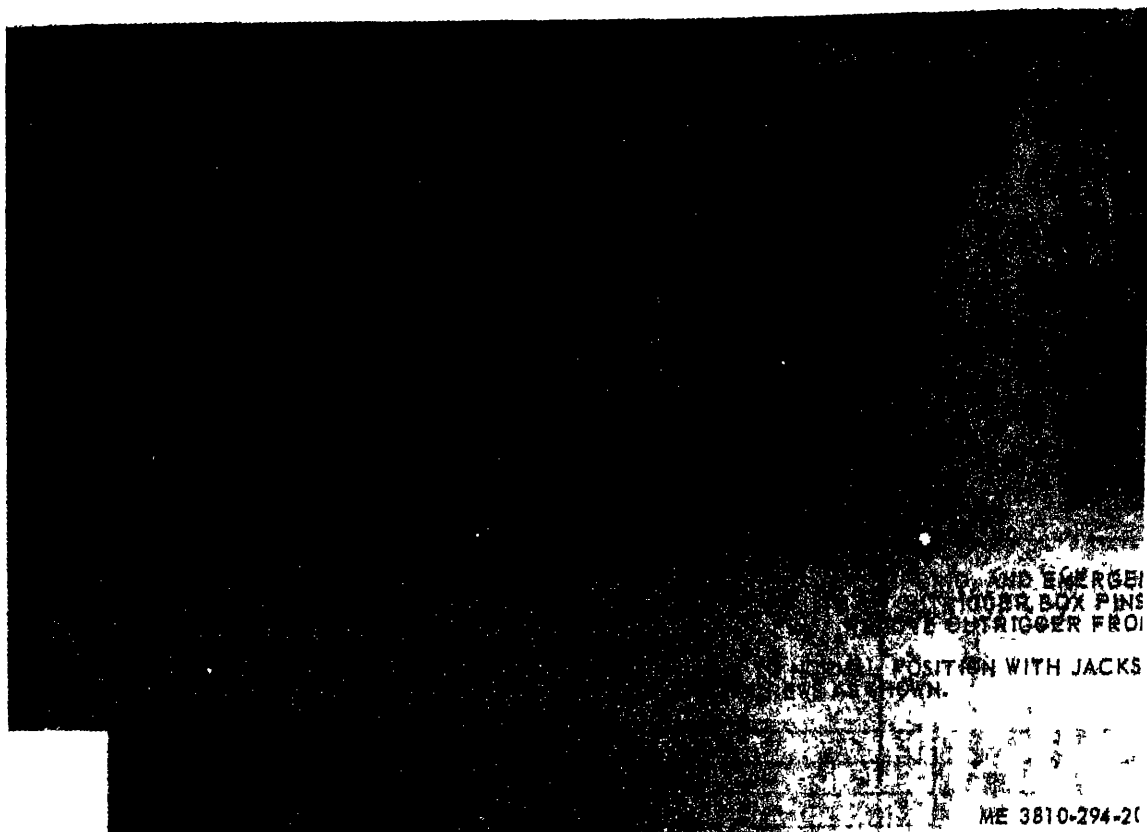


Figure 4-62. Outrigger, removal and replacement (sheet 1 of 2).

- STEP 1. TURN JACKSCREWS DOWN TO RELIEVE PRESSURE ON OUTRIGGER BOX PINS. BLOCK OUTRIGGER SO THAT IT WILL NOT TIP WHEN OUTRIGGER PINS ARE REMOVED
- STEP 2. REMOVE CAPSCREWS, EYE PINS, AND OUTRIGGER BOX PINS. REMOVE OUTRIGGER FROM UNDER CARRIER
- STEP 3. POSITION OUTRIGGER UNDER CARRIER AND RAISE TO NORMAL POSITION WITH JACKSCREWS. INSTALL OUTRIGGER BOX PINS, EYE PINS, AND CAPSCREWS AS SHOWN

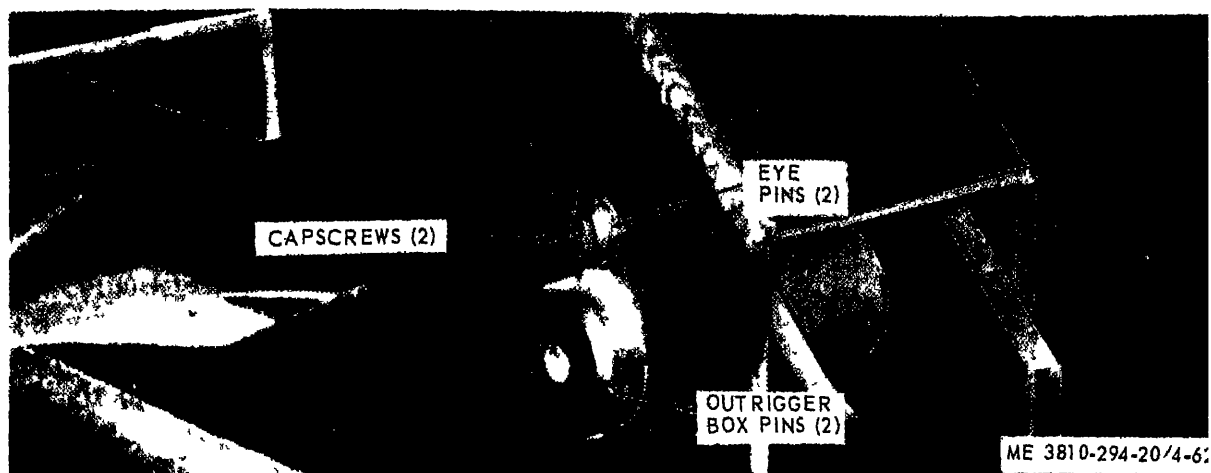


Figure 4-62. Outrigger, removal and replacement (sheet 2 of 2).

Section XXV MAINTENANCE OF FIRE EXTINGUISHER AND TOOL BOX

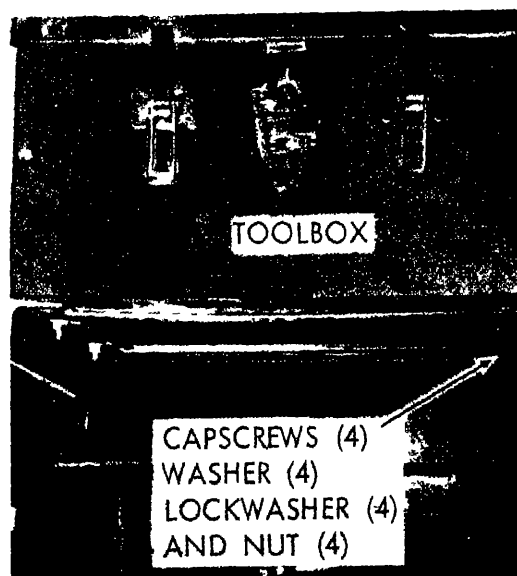
4-95. Fire Extinguisher

Replace fire extinguishers which have been used, the seals of which have been broken, or which have lost weight of 1/4 pound or more, with a like serviceable item.

4-96. Tool Box

a. *Removal* Refer to figure 4-63 and remove the tool box.

b. *Replacement* Replace the tool box as shown in figure 4-63.



- STEP 1. REMOVE NUTS AND LOCKWASHERS.
- STEP 2. REMOVE TOOL BOX.

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Figure 4-63. Tool box installation.

APPENDIX A

REFERENCES

A-1. Fire Protection

TB 5-4200-200-10

Hand Portable Fire Extinguishers for Army Use

A-2. Lubrication

LO 5-3810-294-12
C9100IL

Lubrication Order
Fuels, Lubricants, Oil and Waxes

A-3. Paint

TM 9-213

Painting Instructions for Field Use

A-4. Radio Suppression

TM 11-483

Radio Interference Suppression

A-5. Maintenance

TM 9-1870-1
TB 750-651

TM 38-750
TM 5-3810-294-20P
TM 5-3810-294-10
TM 9-6140-200-15

TB 385-101

Care and Maintenance of Pneumatic Tires
Antifreeze Solutions and Cleaning Compounds
in Engine Cooling System
The Army Maintenance Management System
Organizational Maintenance Repair Parts
Operator/Maintenance Manual
Operation and Organizational Field and Depot
Maintenance, Storage Batteries, Lead-Acid Ty
Safety Use of Cranes, Crane-Shovels, Drag-
lines, and Similar Equipment near Electric
Power Lines

A-6. Shipment and Storage

TB 740-93-2

TM 740-93-1

Preservation of USAMEC Mechanical Equipment
for Shipment and Storage
Administrative Storage of Equipment

A-7. Destruction

TM 750-244-3

Procedures for Destruction of Equipment to
Prevent Enemy Use.



APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. General

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component and the work measurement time required to perform the functions by the designated maintenance level. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III lists the special tools and test equipment required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions or explanatory notes for a particular maintenance function.

B-2. Explanation of Columns in Section II

a. *Column (1), Group Number* A number is assigned to each group in a top down breakdown sequence. The applicable groups are listed on the MAC in disassembly sequence beginning with the first group removed.

b. *Column (2), Assembly Group* This column contains a brief description of the components of each numerical group.

c. *Column 3 Maintenance Functions* This column lists the various maintenance functions (A through K). The lowest maintenance level authorized to perform these functions is indicated by a symbol in the appropriate column. Work measurement time standards (the active repair time required to perform the maintenance function) are shown directly below the symbol identifying the maintenance level. The symbol designations for the various maintenance levels are as follows:

- C — Operator or crew
- O — Organizational maintenance

- F — Direct support maintenance
- H — General support maintenance
- D — Depot maintenance

The maintenance functions are defined as follows:

A. *Inspect*: To determine serviceability of a item by comparing its physical, mechanical, an electrical characteristics with established standards through examination.

B. *Test*: To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

C. *Service*: Operations required periodically to keep an item in proper operating condition i.e., to clean, to preserve, to drain, to paint, to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

D. *Adjust*: To maintain within prescribed limits, by bringing into proper or exact position or by setting the operating characteristics to specified parameters.

E. *Align*: To adjust specified variable elements of an item to bring about optimum or desired performance.

F. *Calibrate*: To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

G. *Install*: The act of emplacing, seating, or fixing into position an item, part, or module (component or assembly) in a manner to allow the proper function of an equipment or system.

H. *Replace*: The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

I. *Repair*: The application of maintenance

services (inspect, test, service, adjust, align, calibrate, or replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

J. Overhaul: That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publication. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

K. Rebuild: Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurement (hours/miles, etc.) considered in classifying Army equipment/components.

d. Column (4). Tools and Equipment. This column is provided for referencing by code the special tools and test equipment, (sec III) required to perform the maintenance functions (sec II).

e. Column (5). Remarks. This column is pro-

vided for referencing by code the remark (sec IV) pertinent to the maintenance function.

B-3. Explanation of Columns in Section II

a. Reference Code. This column contains a number and a letter separated by a dash, entered in column 4 on the MAC. The number indicates the special tools and test equipment requirements and the letter represents the maintenance function the item is to be performed with. The letter is representative of A through K on the MAC.

b. Maintenance Category. This column indicates the lowest level of Maintenance action that can be performed on the item without the use of special tools or test equipment.

c. Nomenclature. This column lists the name or identification of the tools or test equipment.

d. Tool Number. This column lists the manufacturer's code and part number (or Stock Number) of tools and test equipment.

B-4. Explanation of Columns in Section III

a. Reference Code. This column contains two letters separated by a dash, entered in column (5), Section II. The first letter indicates the Remark and the second letter indicates a maintenance function, color-coded A through K, to which the remark applies.

b. Remarks. This column lists information pertinent to the maintenance function to be performed, as indicated on the MAC, Section II.

Section II. MAINTENANCE ALLOCATION CHART (PART I)

(1)	(2)	(3)											(4)	(5)
		Maintenance functions												
		A	B	C	D	E	F	G	H	I	J	K		
Group No.	Assembly group	Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	Tools and equipment	Remarks
01	U-460 CRANE													
	CRANE, SHOVEL AND EARTH WORKING EQUIPMENT													
0101	Shovel Front Attachment			O	O				O					
0102	Boom, Shovel	C		0.4	1.5				5.6	17.5				
0103	Sprockets	0.1							F	F				
0104	Chain			O					7.0	7.6				
0105	Tightener			0.05					O	F				
0106	Dipper, Pulley Assy				O				1.5	2.6				
0107	Stick Assy				0.5				O	O				
0108	Braces, Pitch Assy								1.7	4.2				
0109	Dipper	C							O	O				
0110	Teeth, Dipper	0.05							2.0	3.2				
0111	Rack	C							F	F				
0112	Magnetic Switch, Solenoid and Push Button	0.05							8.0	10.3				
0113	Wire Assembly								D					
02	BACKHOE ATTACHMENT								4.0					
0201	Backhoe			C					O				H	
0202	Boom Assy, Backhoe	C		0.7					2.5	4.6			14.0	
0203	Derrick Assy	0.1		0.5					O	F				

I

(1) Group No.	(2) Assembly group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
0204	Brace, Dipper	C	---	---	---	---	---	---	O	---	---	---		
0205	Teeth	0.05	---	---	---	---	---	---	2.0	---	---	---		
0206	Dipper Assy	0.05	---	---	---	---	---	---	O	---	---	---		
0207	Bracket Assy, Block and Link Assy	C	---	---	O	---	---	---	2.0	3.2	---	---		
03	PILEDRIIVER ATTACHMENT	0.05	---	O	---	---	---	---	O	F	---	---		
	Piledriver Rig	---	---	1.0	---	---	---	---	O	4.6	---	---		
04	CRANE, DRAGLINE, AND CLAMSHELL ATTACH- MENTS	---	---	---	---	---	---	---	---	---	---	---		
0401	Boom, Crane	C	---	O	---	---	---	---	O	F	---	---		
0402	Pulley, Roller Guide	0.05	---	0.5	---	---	---	---	1.5	2.6	---	---		
0403	Block Hook	C	---	O	---	---	---	---	O	F	---	---		
0404	Tagline	0.05	---	0.05	---	---	---	---	O	1.5	---	---		
0405	Bridle Assy	---	---	0.5	0.5	---	---	---	O	2.5	---	---		
0406	Bucket, Clamshell and Dragline	---	---	O	---	---	---	---	O	O	---	---		
0407	Teeth Bucket	C	---	0.2	---	---	---	---	1.6	2.7	---	---		
0408	Fairlead, Boom Harness	0.05	---	---	---	---	---	---	O	O	---	---		
		---	---	---	---	---	---	---	1.7	2.7	---	---		
		---	---	---	---	---	---	---	O	---	---	---		
		---	---	---	---	---	---	---	1.6	---	---	---		
		---	---	---	---	---	---	---	O	---	---	---		
		---	---	---	---	---	---	---	2.3	---	---	---		

(1) Group No.	(2) Assembly group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
0411	Cables -----	C 0.05	---	---	---	---	---	---	O 1.3	---	---	---		
0412	Pulleys -----	---	---	O 0.3	---	---	---	---	O 1.6	F 2.8	---	---		
0413	Sockets and Pins -----	C 0.1	---	---	---	---	---	---	O 1.2	---	---	---		
0414	Backstop Assy -----	---	---	---	---	---	---	---	O 1.3	F 3.2	---	---		
0415	Angle Indicator -----	C 0.1	---	---	---	---	---	---	O 1.3	---	---	---		
05	HULL WIRING HARNESS													
0501	Conduit -----	C 0.1	---	---	---	---	---	---	O 2.6	---	---	---		
0502	Wiring -----	---	---	---	---	---	---	---	F 2.8	O 3.0	---	---		
06	LIGHTS, BATTERIES, AND MISCELLANEOUS ITEMS													
0601	Flood, Clearance, Dome -----	C 0.1	---	---	---	---	---	---	O 1.3	O 1.1	---	---		
0602	Blackout -----	C 0.1	---	---	---	---	---	---	O 1.3	O 1.1	---	---		
0603	Doors, Lens -----	C 0.05	---	---	---	---	---	---	O 1.0	O 1.3	---	---		
0604	Receptacle -----	C 0.05	---	---	---	---	---	---	O 1.3	---	---	---		
0605	Cables, Slave -----	C 0.05	---	---	---	---	---	---	O 1.2	F 1.3	---	---		
0606	Battery -----	C 0.05	O 0.2	C 0.3	---	---	---	---	O 1.1	---	---	---		
0607	Cable -----	C 0.1	---	---	---	---	---	---	O 1.2	---	---	---		

(1) Group No.	(2) Assembly group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
07	ENGINE CONTROL PANEL													
0701	Box and Panel	C							O	F				
0702	Gages	0.1 C							1.1 O	2.0				
0703	Switches and Wiring	0.05 C							2.3 O	O				
		0.05							2.3	1.7				
08	HORN													
0801	Horn, Button, Wiring	C 0.05							O	O				
									2.0	1.3				
09	RADIO INTERFERENCE SUPPRESSION													
0901	Components								O					
									1.7					
10	GAGES								O					
1001	Tachometer	C 0.05							1.1					
11	EXHAUST SYSTEM													
1101	Muffler and Pipes	C 0.05							O					
12	CAB ASSEMBLY								1.7					
1201	Cab								F	H				
									21.0	31.2				
1202	Doors								O	H				
									2.3	12.6				
1203	Glass	C							O	H				
		0.05							3.1	5.6				
13	SEATS													
1301	Cushion	C							C	H				

(1) Group No.	(2) Assembly group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
14	BOXES, TOOL													
1401	Box	C 0.05							O 1.0	F 2.6				
15	GANTRY ASSY													
1501	Gantry	O 0.05							O 1.3	H 3.0				
16	ACCESSORY ITEMS													
1601	Heater and Switch	C 0.05							O 2.2	F 2.3				
1602	Defroster Hose	C 0.05							O 0.5					
1603	Wiring	C 0.05							O 0.7	F 0.9				
17	HYDRAULIC SYSTEM													
1701	Hose, Fitting, Tubing	C 0.05							O 2.3	F 3.3				
1702	Manifold and/or Control Valves								O 2.2	F 3.7				
1703	Master Cylinder			O 0.05					O 1.3	F 2.0				
1704	Cylinder Hydraulic			O 0.1					O 1.3	F 1.5				
1705	Liquid Reservoir	C 0.05		O 0.05					O 1.1					
18	COOLING SYSTEM													
1801	Radiator	C 0.05	H						O 1.7	H 4.0				
1802	Hoses	C 0.05	C 0.05						O 1.2					
1803	Cowling								O 1.7	F 3.0				
1804	Cap	C	O											

(1)	(2)	(3)											(4)	(5)	
		Maintenance functions													
		A	B	C	D	E	F	G	H	I	J	K			
Group No.	Assembly group	Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	Tools and equipment	Remarks	
19	TRANSMISSION ASSY AND PROPELLER SHAFT														
1901	Transmission	C		O					F	H	H				
1902	Transmission Shaft	0.05		0.2					2.1	3.0	3.0				
	Gears, Bearings, Seals	H							H						
1903	Propeller Shaft Assy	1.0							6.5						
				O					O	F					
				0.05					1.6	3.2					
20	FUEL SYSTEM														
2001	Air Cleaner Assy			O					O						
2002	Tank, Lines, Fittings			0.5					1.2						
				C					O	F					
2003	Fuel Filters			0.5					2.6	3.0					
				O					O						
2004	Engine Speed Governor and Controls			0.5	O				1.2	F					
					0.5				O	2.2					
2005	Engine Starting Aids								1.6						
		C							O						
2006	Throttle and Choke Controls	0.05							1.7						
		C			O				O	O					
2007	Carburetor	0.05			0.5				1.3	1.9					
				O	O				O	H					
2008	Fuel Pump			0.1	0.1				1.8	2.2					
			O						O						
			0.5						1.8						
21	COOLING SYSTEM ACCESSORIES														B-B
2101	Thermostat, Housing, Gasket								O						
2102	Water Pump			C					1.0						
									O						
				0.05					2.2						

(1)	(2)	(3)											(4)	(5)
		Maintenance functions												
		A	B	C	D	E	F	G	H	I	J	K		
Group No.	Assembly group	Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	Tools and equipment	Remarks
22	Guard	---	---	---	---	---	---	---	O	F				
	ELECTRICAL SYSTEM	---	O	---	---	---	---	---	O	H				C-B
	GENERATOR/ ALTERNATOR	---	1.0	---	---	---	---	---	1.5	3.2				
2201	Belt	C	---	---	O	---	---	---	O					
23	STARTER ASSEMBLY	0.05	---	---	0.5	---	---	---	1.0					
		---	O	---	---	---	---	---	O	H				D-B
		---	0.5	---	---	---	---	---	2.2	3.1				
2301	Solenoid Assy	---	O	---	---	---	---	---	O					E-B
24	IGNITION COMPONENTS	---	0.5	---	---	---	---	---	1.1					
	Distributor Assy	---	O	O	---	---	---	---	O	F				F-B
		---	---	0.05	---	---	---	---	0.5	1.3				
2402	Coil	---	O	---	---	---	---	---	O					
2403	Spark Plugs	---	0.5	---	---	---	---	---	O					
		---	O	---	---	---	---	---	O					
		---	0.8	---	---	---	---	---	1.5					
2404	Wires, Suppression	---	O	---	---	---	---	---	O	F				
25	SENDING UNITS	---	0.8	---	---	---	---	---	1.5	2.6				
		---		---	---	---	---	---						
	Sender	---	---	---	---	---	---	---	O					
2501		---	---	---	---	---	---	---	0.2					
2502	Wires	---	---	---	---	---	---	---	O					
		---	---	---	---	---	---	---	O					
		---	---	---	---	---	---	---	0.5					
2503	Lights	C	---	---	---	---	---	---	O					
26	ENGINE ASSEMBLY	0.05	---	---	---	---	---	---	0.3					
		---	---	---	---	---	---	---						
	Engine	C	O	O	---	---	---	---	F	H	H	D		G-B
2601		0.05	1.5	1.0	---	---	---	---	12.0	3.3	46.0	80.0		
2602	Crankcase	O	---	O	---	---	---	---	H	H				
		0.5	---	1.0	---	---	---	---	23.0	26.0				

(1)	(2)	(3)											(4)	(5)
Group No.	Assembly group	Maintenance functions											Tools and equipment	Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
2603	Head Cylinder								F	H				
2605	Crankshaft	H							2.7	6.2				
2606	Flywheel Assy	0.8							H	D		D		I-I
		F							18.0			16.0		
2607	Pistons and Connecting Rods	0.5							F	H				
2608	Pistons, Rings, Pins	H							7.0	2.0				
2609	Rods, Connecting	1.7							H	H				
2610	Pan, Oil	1.8							16.0	8.3				
2611	Valves, Camshaft	H				H			H	H				
2612	Timing System	1.8				3.6			12.0	8.0				
2613	Valves and Inserts	C		O					F	H				
2614	Arms, Rocker	0.05		0.5					3.3	2.1				
2615	Tappets								H	H				
2616	Camshaft, Bearings, Gear	O							8.0	4.0				
2617	Cover	0.8							F	H				
		H							4.3	3.7				
		0.1			O				F					O-D
27	LUBRICATING SYSTEM				2.5				6.0					
2701	Pump, Oil	F							H					
2702	Filter, Oil	0.6							12.0					
				O					H					
2703	Lines, External			0.5					2.5					
28	MANIFOLDS													
2801	Exhaust	C							F					
2802		0.05							3.9	2.6				
									O					
									0.7	O				
									O	1.2				
									0.8					
									</					

(1) Group No.	(2) Assembly group	(3) Maintenance functions												(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K			
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild			
29	ACCESSORY DRIVE														
2901	Shaft								O	F					
2902	Housing								1.1	1.7					
									O	F					
									1.8	2.1					
30	CLUTCH ASSY														
3001	Clutch	O		O	O				F	F				I-H	
		0.05		0.2	1.0				10.6	6.7					
31	CRANES, SHOVELS AND EARTH WORKING EQUIPMENT														
3101	Engine Clutch Shaft			O					F	F					
				0.5					5.4	4.0					
3102	Chain and Sprocket				O				F						
					1.0				2.3						
3103	Horizontal Swing Assy			O	O				F	H					
				1.0	1.0				10.0	12.0					
3104	Clutch Bands	C		O					F	H					
		0.05		0.5					2.6	1.6					
3105	Chain Assy	O							O						
		0.05							1.8						
3106	Boom Hoist Shaft Assy			O	O				H	H					
				0.8	0.5				5.8	7.0					
3107	Chain Assy	C							O						
		0.05			0.5				1.9						
3108	Brake and Clutch Bands	C			O				O	H					
		0.05			1.0				1.3	2.2					
3109	Independent Boom Hoist			O	O				H	H					
				0.9	1.0				12.0	8.7					
3110	Clutch and Brake Bands				O				O	F					
					0.8				1.2	2.9					
3111	Chain Assy				O				O						
					0.5				2.1						
3112	Boom Shaft Hoist Assy			O					H	H					

(1) Group No.	(2) Assembly group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
3113	Chain Assy				O									
3114	Brake and Clutch Bands				0.6				O	2.3				
3115	Independent Boom				O				O					
3116	Hoist Assy				1.0				1.6	2.1				
3117	Clutch and Brake Bands			O	O				H	H				
3118	Chain Assy			0.05	1.5				14.5	7.8				
3118	Clutch Jaw				O				O	F				
3119	Swing Lock and Brake	H		0.1	0.3				2.7	2.3				
3120	Vertical Swing Shaft	0.05		0.2					10.0					
3121	Machinery Gear Case	C		O					H					
3122	Machinery Mechanism	0.05		0.1					12.2					
3122	Controls	C		O					O					
3124	Linkage	0.1		0.7					4.7	O				
3125	Jack Shaft Center Drive	C		O	0.6				O	1.1				
3126	Base Deck	0.05		0.1					1.9					
3127	Mounting Base	O		O	O				O	O				
3128	Rotating Base	0.05		0.05	0.2				1.1	1.3				
				O					H					
				O					8.3	H				
				O					F	12.0				
				0.2					8.5	H				
				1.3					H	22.0				
				O					H	H				
				0.8					19.0	23.0				
									F	F				

(1) Group No.	(2) Assembly group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
32	MISCELLANEOUS ITEMS													
3201	Data Plates	0							0					
		0.05							0.1					
3202	Caution Plates	0							0					
		0.05							0.1					
3203	Mirrors	0							0					
		0.05							0.6					
3204	Fire Fighting Equipment	0							0					
		0.05							0.05					
		0							0	F				
3205	Cables	0.05							1.8	1.2				

Section II. MAINTENANCE ALLOCATION CHART (PART II)

(1) Group No.	(2) Assembly group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
01	V-649 CARRIER CARRIER CAB ELECTRICAL SYSTEM													
0101	Wiring Harness								O	F				
0102	Panel	C							4.2	2.7				
0103	Switches, Gauges, Lamps	C							O					
		0.05							1.8					
		C							O					
		0.05							2.8					
02	MISCELLANEOUS ITEMS													
0201	Switches, Receptacle	C							O					
0202	Cables	C							1.7					
0203	Wiring	C							O	O				
		0.05							1.2	1.3				
									O	O				
									1.7	2.1				
03	LIGHTS													
0301	Headlights	C							O	O				
0302	Clearance, Dome, Park	0.1							1.7	1.1				
		C							O	O				
0303	Directional, Tail, Stop	C							1.3	1.5				
		0.05							O	O				
0304	Blackout, Tail, Head	C							2.3	2.8				
		0.05							O	O				
0305	Trouble light	C							2.0	1.9				
		0.05							O	O				
									1.3	1.8				
04	SENDING UNITS;													
0401	Sending Units	O							O					
		0.5							1.2					
05	HORN	C							O					
	Horn Button Wiring													

(1) Group No.	(2) Assembly group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
06	BATTERIES													A-B
0601	Battery	C 0.05	O 0.1	C 0.1					O 1.1					
0602	Cables	C 0.1							O 1.2	O 1.2				
07	BODY, CAB, HOOD ASSY													
0701	Cab								F 12.0	F 11.0				
0702	Door	C 0.05							O 1.5	F 3.0				
0703	Glass	C 0.05							O 4.0					
0704	Hood								O 1.1	F 2.2				
0705	Fender								O 1.3	F 3.4				
08	ACCESSORY ITEMS													
0801	Windshield Wiper	C 0.05							O 1.3	F 1.8				
0802	Windshield Washer	C 0.05							O 1.0					
0803	Wiper Blades	C 0.05							O 1.0					
0804	Data Plates	C 0.05							O 1.1					
09	GAGES													
0901	Instruments, Speed and Distance	C 0.05							O 2.5					
10	COOLING SYSTEM													
1001	Radiator			C 0.05					O 2.0	H 2.9				
1002	Hoses	C 0.05							O 2.1					

(1) Group No.	(2) Assembly group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
1003	Cowling								O	F				
1004	Cap	C							2.8	3.0				
11	ENGINE ASSY, FUEL SYSTEM	0.05							O					
1101	Air Cleaner Assy			O					O					
1102	Tanks, Lines, Fittings			0.5					1.3	H				
1103	Filters, Fuel			C					2.6	4.2				
1104	Engine Governor			C					O					
1105	Controls			0.5	O				1.7	F			2-D	
1106	Carburetor				0.5				2.1	3.0				
1107	Fuel Pump				O				O	F				
1108	Starting Aids	C	0.5						1.2	1.6				
1109	Lines and Fittings, Tank	0.05							O	F				
1110	Accelerator, Throttle and Choke Controls			0.1					0.9	2.3				B-B
12	EXHAUST SYSTEM								O					
1201	Muffler and Pipes	C							1.5	O				
13	COWLING	0.05							1.5	2.8				

(1) Group No.	(2) Assembly group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
14	AIR LINES, COUPLINGS													
1401	Couplings -----	C							O					
		0.05							2.1					
1402	Lines -----	C							O					
		0.05							1.5					
15	FAN AND WATER PUMP													
1501	Pump, Water -----								O	F				
									2.5	2.3				
16	FAN ASSEMBLY													
1601	Bearing, Shaft, Pulley -----			O					O					
				0.05					1.1					
1602	Fan -----	C							O					
		0.05							0.6					
1603	Belt -----	C			O				O					
		0.05			0.5				1.5					
17	ELECTRICAL SYSTEM													
1701	Alternator -----		O						O	F				C-B
			0.5						1.5	3.2				
1702	Belt -----	C			O				O					
		0.05			0.2				1.0					
18	STARTER MOTOR													
			O						O	F				D-B
1801	Solenoid -----		0.5						2.2	3.2				E-B
			O						O					
			0.5						1.1					
19	IGNITION COMPONENTS													
1901	Distributor -----		O						O	F				F-B
			0.9						1.0	1.7				
1902	Coil -----	O							O					
		0.5							0.8					
1903	Spark Plugs -----	O			O				O					
		1.8			1.2				1.9					
1904	Wiring Suppression -----	O							O	F				

(1) Group No.	(2) Assembly group	(3) Maintenance functions												(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K			
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild			
20	MANIFOLDS														
2001	Exhaust	O							O	F					
2002	Intake	0.05							2.9	3.1					
		O							3.0	2.0					
21	LUBRICATION SYSTEM														
2101	Pan Oil	C		O					F	F					
2102	Pump Oil	0.05		0.5					2.2	4.0					
2103	Cooler Oil								F	F					
2104	Filter Oil								1.3	2.4					
2105	Lines External								O	F					
				O					1.3	2.1					
				0.5					O						
									2.1						
									O	2.1					
22	ACCESSORY DRIVE MECHANISM								1.8						
2201	Shaft														
2202	Housing								O	F					
									0.8	0.9					
									O	F					
									1.3	1.5					
23	ENGINE ASSY														
2301	Engine	C	O	O					F	H	H	D		G-B	
2302	Crankcase	0.05	1.8	1.5					22.0	3.9	46.0	98.0			
2304	Head Cylinder	0.05		1.5					H	H					
									28.0	32.0					
									F	H					
2305	Crankshaft Assy								4.8	8.3					
2306	Crankshaft bearings	H							H	D		D		H-I	
		0.8							18.0	12.0		12.0			
2307	Flivwheel Assv	0.9							H					I-I	
									18.0						
									F	F					

(1) Group No.	(2) Assembly group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
24	PISTON, CONNECTING RODS													
2408	Pistons, Rings, Pins	H 19							H 12.0					
2409	Rods, Connecting, Bearings	H 18				H 4.3			H 19.0	H 8.0				
25	VALVES, CAMSHAFT AND TIMING SYSTEM													
2501	Valves and Inserts								F 12.0	F 6.0				
2502	Arms, Rocker and Shaft								F 2.3	F 3.7				
2503	Tappets	F 0.9							F 6.0					
2504	Camshaft, Bearings and Timing Gear	F 0.9							F 16.0					
2505	Cover	O 1.0							H 2.5					
26	CLUTCH													
2606	Clutch Assy				O 1.1				F 7.3	F 3.9				I
2607	Clutch Release Mechanism Linkage, Pedal, Yoke Bearing				O 1.3				F 2.9					
27	TRANSMISSION													
2701	Transmission Assy	C 0.05		O 0.5					F 2.4	H 3.9				
2702	Transmission Control Assy	O 0.05							F 2.1	F 3.2				
	Transmission Cover	O							O					

(1) Group No.	(2) Assembly group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
28	TRANSFER ASSY													
2801	Controls			O					O	O				
2802	Transfer Assy	C		0.05					1.3	2.1				
		0.05		C					F	H				
				0.5					2.1	4.5				
29	STEERING ASSEMBLY													
2901	Power Steering Assy		O						F	F				J-B
2902	Hydraulic Pump		1.3						3.9	5.7				
2903	Belt	C	1.3		O				O	F				
2904	Hoses Lines Fittings	C			0.5				1.9	3.2				
2905	Reservoir	0.05							O					
				C					1.3					
2906	Tie rods, Drag Link			0.05		D			O					
2907	Wheel Steer	C				2.0			O					
2909	Steering Column Assy	0.05							1.5					
		C							O	F				
		0.05							1.8	3.2				
30	AIR BRAKE SYSTEM													
3001	Relay Valve	C							O					
3002	Chamber, Brake	0.05							2.1					
3003	Evaporator								O	F				
									1.8	2.1				
									O	F				
3004	Reservoir	C		C					0.5	1.3				
		0.05		0.05					O					
									1.3					

(1) Group No.	(2) Assembly group	(3) Maintenance functions										(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul		
32	BRAKES												
3201	Brake Service								F 8.7	F 6.3			
3202	Shoes								F 6.3	F 6.3			
33	PROPELLER SHAFTS												
3301	Shafts			O 0.1					O 2.3	F 3.6			
34	WHEELS, TRACK AND SUSPENSION												
3401	Torque Rod								H 7.3	H 6.2			
3402	Wheel Assembly	C 0.05							O 1.3				
3403	Tires and Tubes	C 0.05		C 0.1					O 3.3				
35	SPRINGS, SHOCK ABSORBERS												
3501	Torque Rods								H 12.6	H 13.2			
3502	Springs								F 16.0	F 8.2			
3503	Shock Absorbers	C 0.05							O 8.2				
36	FRONT AXLE												
3601	Axle Assembly								F 3.2	F 13.6			
3602	Differential Assy			O 0.1					F 8.3	H 12.2			
37	REAR AXLE												
3701	Axle Assy								F 3.2	H 4.6			

(1) Group No.	(2) Assembly group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
3702	Differential			O 0.1					F 8.3	H 12.2				
38	PNEUMATIC COMPRESSOR													
3801	Compressor Assy			O 0.5	O 1.0				F 2.2	H 6.2				
3802	Pulley	C							O 1.3					
3803	Belt	C			O 0.5				O 1.3					
3804	Tanks	C							O 1.7					
3805	Strainer, Alcohol Evaporator	C		O 0.5					O 0.5					
39	FRAME ASSY													
3901	Frame	C							H 23.0	H 17.0				
3902	Pintle	0.1		O 0.05					O 1.5					
3903	Outriggers	C		O 0.1					O 3.8	H 10.6				
40	EXTINGUISHER, FIRE	0.1												

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Reference code	Maintenance category	Nomenclature	Tool number
1-H 2-D	F,H O	Clutch Alinement Tool (Stub Shaft) Adjust Governor	SE20272-1 (81007)

Section IV. REMARKS

Reference code	Remarks
	CARRIER
A-B	On vehicle test
B-B	On vehicle test
C-B	On vehicle test
D-B	On vehicle test
F-B	On vehicle test
F-B	On vehicle test
G-B	Compression
H-I	Metalize and resize
I-I	Install ring gear only
J-B	On vehicle test
	CRANE
A-B	On vehicle test
B-B	On vehicle test
C-B	On vehicle test
D-B	On vehicle test
E-B	On vehicle test
F-B	On vehicle test
G-B	Compression
H-I	Metalize and resize
I-I	Install ring gear
J-D	On vehicle adjust

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Official:

CREIGHTON W. ABRAM
General, United States Army
Chief of Staff

VERNE L. BOWERS,
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